

# COAL TRUCK DRIVER TRAINING PROGRAM

## TRAINING MANUAL



WEST VIRGINIA OFFICE OF MINERS' HEALTH,  
SAFETY AND TRAINING

## PRE-OPERATIONAL INSPECTION PROCEDURES: (Classroom)

### Overview

**Prerequisites:** None

### **PURPOSE:**

The purpose of this lesson is to introduce students to the reasons for conducting pre-operational inspections, what constitutes a safety defect and to present a systematic procedure for conducting pre-operational inspections.

### **MATERIALS:**

#### Instructional Aids

Powerpoint Presentation, Pre-Operational Inspection Video

#### Student Materials

Training Manual Walk around sequence illustration, and Pre-operational check list.

#### Instructor Materials

Training Manual (the instructor should have copies of mine safety and highway safety regulations available for reference).

### Content

1. The importance of pre-operational inspections
2. The types of vehicle inspections
3. What to look for when inspecting vehicles
4. Pre-operational inspection procedures
5. Reporting requirements
6. Summary and review

NOTE: This lesson does not include any details about the inspection and adjustment of air brakes. Since air brakes are such a critical pre-operational inspection item they will be covered in their own separate lesson.

## INSTRUCTOR OVERVIEW – PRE-OPERATIONAL INSPECTIONS

### **PURPOSE**

The purpose of this lesson is to stress the importance of systematic vehicle inspections and to help develop the skills necessary for good inspections. Students should learn the pre-operational inspection procedures used throughout this course.

### **KNOWLEDGE OBJECTIVES**

Student must know:

- A systematic procedure to assure a rapid, accurate and complete pre-operational inspection.
- The effect of undiscovered malfunctions upon safety, effectiveness, and economy.
- The importance of having malfunctions corrected quickly.
- Federal, State and other regulations governing inspection.
- Procedures for post-shift inspection.

Students must learn to not operate a vehicle found to be in unsafe operating condition, whether unsafe for the driver, coworkers, other road users or the vehicle prior to or during a shift.

### **PERFORMANCE OBJECTIVES**

Students must be able to:

- Inspect and determine the condition of various critical vehicle components, including instruments and controls; engine and drive train; suspension; steering system; braking system; tires, wheels and rims; lighting and signaling systems; and emergency equipment.
- Perform pre-operational inspections in a regular, systematic sequence that is accurate, uniform and time efficient.
- Perform during shift inspections by checking mirrors for signs of trouble; monitoring instruments; looking, listening and feeling for indications of malfunctions; making periodic inspections of critical items when the vehicle is stopped.
- Perform post-shift inspections by making accurate notes of actual and suspected component problems or malfunctions that occurred during the shift.
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## **THE IMPORTANCE OF PRE-OPERATIONAL INSPECTIONS**

Large amounts of coal are still transported on and off mine property. Accidents, injuries and fatalities involving coal trucks are still happening. Many of these accidents could be prevented if a proper pre-operational inspection of the vehicle is performed by the driver, and defects corrected prior to operation. It must be understood by all persons involved with haulage that there is no acceptable number of accidents, injuries or fatalities, no matter how much haulage is taking place.

There is no place in today's mining environment for any person that is untrained or unwilling to perform the proper inspections required by law.

**INSTRUCTOR'S NOTE:** Any direct knowledge that the instructor can share with the class relating to vehicle accidents, breakdowns, citations or fines that may be related to improper inspection will help personalize the importance of proper inspections.

### **The Student**

#### Is to Identify

- ☛ A system or part that is malfunctioning, has already failed, or is missing
- ☛ A system or part that is in eminent danger of failing or malfunctioning
- ☛ A system or part that is functioning properly
- ☛ The legal requirements for various parts or system conditions

### **Vehicle Inspection Responsibility**

#### A Driver is Responsible For

- ☛ Maintaining a safe working environment
- ☛ The safety of the vehicle
- ☛ Safe delivery of the cargo

#### Vehicle Inspection is Part of the Job

- ☛ It provides for detection of most potential malfunctions
- ☛ Inspection does not require a trained mechanic

## **The Four Basic Reasons for Inspection**

**Safety** – Is the most important and obvious reason inspections help to avoid the mechanical defects and malfunctions that increase the likelihood of an accident.

**Economy** – Poorly done or skipped inspections cost money. Small maintenance problems can quickly become big repairs. Unattended problems shorten vehicle life. Breakdowns or “out-of-service” can cause lost production, towing costs and overtime for mechanics.

**Public Relations** – Our industry needs the public’s good will.

Bad publicity results from:

- Accidents
- Breakdowns that cause traffic delays
- Poor condition or appearance of vehicle

## **Legality**

- Federal and State Law, Title 56 Series 3 Section 42.1.4 ((a) (b) (c) and (d)) require inspections
- Inspections are also conducted by Federal and State Inspectors
- Equipment not meeting requirements can be put “out-of-service” until repairs are made

**INSTRUCTOR’S NOTE:** Now is the time to tell what the company expects from the driver. Be specific as to any special requirements especially if they go beyond legal requirements and would not be covered in this program. Emphasize that no one can afford missed or improper inspections.

## **Why so much emphasis on pre-operational inspections?**

- Accident investigations show that many drivers have not been performing adequate pre-operational inspections. This program is for those who have never been properly trained and for those drivers that need a refresher on pre-operational inspections.
- It is a professional driver’s duty to drive safely. You cannot do this with a defective vehicle.
- It is in a driver’s best interest. Doing a good inspection is not only a sign of professionalism, it can save lives.
- The safety of co-workers and other motorists. Each driver has a responsibility to those around them to be safe.
- A vehicle system or part that is defective can cause increased operating cost.

## **Characteristics of a Good Pre-Operational Inspection**

### **Consistent**

The inspection is always performed in the same sequence each and every time.

Developing and practicing a consistent sequence is the only way to perform a quality inspection.

**Efficient**

An efficient inspection sequence reduces the amount of time required for inspection by eliminating wasted motion.

**Thorough**

While it is not possible to conduct an inspection as thoroughly as a trained mechanic, it is the things that drivers can and should be able to spot, that are most likely to cause breakdowns and/or accidents.

Inspection of critical items should be thorough enough to ensure the safety and legality of the vehicle.

**THE TYPES OF VEHICLE INSPECTIONS****THREE TYPES OF INSPECTION****Pre-Operational or Pre-Trip Inspection**

A systematic vehicle component check must always be conducted prior to each shift to detect defects that could cause accidents, breakdown or inferior performance. The pre-operational inspection is required by State and Federal law when operating machinery on mine property. State and Federal law also requires a pre-operational inspection before operating a commercial motor vehicle on public highways.

Common sense should tell the operator of any machinery that inspection prior to operation is necessary to protect the safety of the operator, co-workers and the public.

**During Shift or – route Inspections**

The monitoring of instruments and mirrors while driving, along with the senses of sight, hearing, smell and feel are essential to discovering problems that may develop during a shift.

If a vehicle is stopped during a shift, items critical to the safe operation of the vehicle should be checked.

For example:

- |   |                            |
|---|----------------------------|
| ☛ Tires, wheels and rims                    | ☛ Trailer coupling devices |
| ☛ Brakes                                    | ☛ Tailgate latches         |
| ☛ Lights                                    | ☛ Tarp                     |
| ☛ Air, electrical and hydraulic connections |                            |

En route inspections are required by law when operating a commercial motor vehicle on public highways at least every 150 miles or 3 hours.

### **Post-Shift or Post-Trip Inspection**

Identify any problems you have found during your shift or trip. Conduct a walk around inspection of the vehicle to further identify or locate any problems. If the vehicle is operated on the highway complete an accurate post-trip or post-shift inspection report in writing.

## **WHAT TO LOOK FOR WHEN INSPECTING VEHICLES**

### **Items That Interfere with Visibility**

- It is not possible to safely operate a vehicle when the driver's vision is impaired, or others cannot see the vehicle. Make sure that you can see, and others can see you.
- Cab windows must be clean inside and out and free of labels, stickers or other vision reducing matter, except those required by law.
- Windshield wipers must operate properly (not smearing or scratching)
- Clean and adjust rearview mirrors
- All lights and reflectors must be clean and working (harsh environments will require frequent cleaning)
- Horns must be working so that you can warn others

### **Tires**

Tire defects increase the chances of a blowout, losing control of the vehicle or being stranded in a place you don't want to be. Federal and State regulations forbid operation with bad tires. The following are defects that should be corrected before operating a vehicle:

- Low air pressure
- Badly worn (minimum 4/32" on the steering, 2/32" on drive and trailer tires)
- Cut deep enough to damage the fabric or steel reinforcement of the tire body
- Mismatched steering tires (radial and bias-ply)
- Dual tires on the same wheel position that are of different height or type which will not allow both tires to carry their share of the weight.
- Kissing or rubbing tires, i.e., dual tires that meet each other or parts of the vehicle.
- Valve stems that are cut or too near a wheel spoke

### **Wheels and Rims**

Defective wheels or rims could cause a wheel or tire to come off and be the cause of a serious accident. A driver must check for:

#### **Bent or damaged rims**

- Rust streaks that indicate the rim is loose on the wheel. This normally is associated with disc type wheels. A loose lug nut will generally cause a streak of rust that runs from the lug nut towards the outer edge of the wheel.
- Stud or bolt holes that are elongated (out of round).



- If a tire has been changed pay close attention to that wheel. The lug nuts will probably need to be retightened after the vehicle has been operated.
- Missing clamps, spacers, studs, or lug nuts. If the vehicle is inspected by an enforcement officer, and any of these items are missing, the vehicle will probably be placed out of service.
- Mismatched, bent, cracked, lock rings are trouble. Do not attempt to make any repairs to a wheel with a lock ring problem. This requires special training and tools.
- Unevenly tightened lugs. With some wheels this will cause wheel wobble. This can cause premature tire failure and excessive vibration.
- Wheels or rims that have welded repairs are not safe.

**NOTE: When inflating a tire, ALWAYS use a clip-on chuck with sufficient length of hose to permit standing clear of the potential trajectory of the wheel components and use an in-line valve with gauge or pressure regulator preset to a desired value. Never stand in front of or over a tire while it is being inflated.**

### **Steering System Defects**

Any defect in the steering system is hazardous. A driver must always be able to maintain control of the vehicle.

Any steering problem is magnified by higher speeds, heavy loads and/or rough terrain. A driver must look for:

- Missing parts including nuts, bolts and cotter keys.
- Bent, loose, or broken parts, such as the steering column, steering gear box, or tie rods.
- If the vehicle is equipped with power steering, check the hoses, pump, and fluid level. Look for leaks and cracked or swollen hoses.

### **Suspension Systems**

The suspension supports the vehicle and its load and maintains the axle alignment and attachment. Any serious failure could have tragic results especially with vehicles that operate in a severe service environment.

Driver should check for:

- Cracked or broken torque arms, spring hangers and U-Bolts.
- Any spring hanger, torque arm or other attaching part that allows an axle to move from it's proper position.
- Missing or broken leaves in any leaf spring. In a severe service environment, any damage to a leaf spring is dangerous. On highway rules allow up to one fourth of a leaf springs to be damaged provided it is not a main leaf or an attaching leaf.

**INSTRUCTOR'S NOTE: At this time, you should explain company rules about damaged springs. If your company does not have a specific policy on damaged spring, you may have to rely on past enforcement activities and operating history. Keep in mind that any company policy that allows operation with a damaged spring could cause problems in case of an accident. Most**



**companies only allow operation with damaged springs when the vehicle is empty and being returned to a repair shop.**

- Any broken leaves in a multi-leaf spring or leaves that have shifted and come in contact with tires, wheels, frame or body cannot be operated
- Air suspension systems that are damaged and/or leaking. They must be repaired before loading the vehicle.
- Any loose, cracked, broken or missing frame members.

### **AIR, ELECTRICAL, AND HYDRAULIC LINES**

Most lines and hoses have a reinforcing layer that is woven fabric or steel mesh. When inspecting lines and hoses there can be no lines worn into the reinforcing layer. If the line or hose is plastic it cannot be badly worn, chaffed or have any cracks. Electrical wires must not be worn through the insulation.

The air, electric and hydraulic lines to the trailer must be secured against tangling, snagging and chafing. Air lines must be properly connected to the glad hands with no air leaks and have sufficient slack for turns. Wet line connections must be secure and not leaking.

### **Exhaust System Defects**

Faulty exhaust system can lead to fumes in the cab or sleeper berth. While diesel fumes are generally more irritating than poisonous, they can make a driver drowsy. If the vehicle is gasoline powered exhaust fumes can put a driver to sleep permanently. A driver should check for:

- Loose, broken, or missing exhaust pipes, mufflers, tailpipes or vertical stacks
- Mounting brackets and their attaching parts that are loose, broken, or about to fail.
- Exhaust system parts rubbing against fuel system parts, tires or other moving parts of the vehicle.
- Exhaust system parts that are leaking.
- Exhaust systems that do not extend beyond or past the driver's compartment.

### **Coupling System**

Most failures related to the coupling system are the result of an incomplete coupling of the tractor and trailer. When inspecting a combination unit, a driver must physically look to see that the coupling is complete. The driver should also check the following when checking for a complete coupling:

- The fifth wheel release must be in the locked position and any locking levers or safety catch must be in place.
- The locking jaw or jaws of the fifth wheel must be around the shank of the king pin.
- There should not be excess slack in the fifth wheel locking mechanism.
- There should be no cracks or breaks in any part of the fifth wheel assembly.
- There must be no missing pins or other defects in the slide mechanism of sliding the fifth wheel.

- The fifth wheel mounting device(s) cannot have missing bolts, cracked or broken welds or other defects.

**NOTE:** During periods of heavy use, it is recommended that the truck be disengaged from the trailer and the complete inspection of the fifth wheel slide and coupling device be completed by the driver. This inspection needs to be made frequently according to the use of the vehicle and the conditions under which hauling occurs. Consult your manufacturer's recommendations.

### **Cargo Problems**

Make sure that the tailgate latch is working properly. If the vehicle is already loaded with an improperly latched tailgate, do not move the vehicle without the permission of your supervisor.

Make sure your tarp is present, in usable condition, and large enough to cover the load carried. The load should not exceed the point in the cargo body where it can fall off the vehicle.

**NOTE:** If your company policy does not allow a driver to climb on top of the unit to tarp the vehicle or work on a tarp, say so now. Make sure that your drivers know when, where, and if it is permissible for them to get on top of the vehicle.

## **PRE-OPERATIONAL INSPECTION PROCEDURES**

In this class you will be taught the "**SEVEN STEP PRE-OPERATIONAL INSPECTION PROCEDURES.**" This method should become a regular part of your daily routine.

You will notice that there is only an occasional mention about the braking system in this lesson. Since the inspection and adjustment of air brakes are such a critical part of a pre-operational inspection, they will be covered in a separate lesson.

### **Inspection Procedures**

The seven-step pre-operational inspection procedure is intended to be a visual inspection only and requires no tools. In order to do an effective inspection a driver should have a rag, gloves and a flashlight.

#### **Step 1. Approaching the Vehicle**

Note the general condition of the vehicle. Fresh leaks indicate sure trouble. Chock the wheels of the vehicle front and rear. **You cannot safely do an inspection without chocking the wheels!**

#### **Step 2. Check Under the Hood**

Raise the hood and secure it against motion (falling). Check the following items with the hood up:

- ☛ Engine oil level
- ☛ Coolant level in radiator or overflow tank
- ☛ Power steering fluid level and hoses
- ☛ Look for leaks in the engine compartment
- ☛ All belts must be checked for tension and signs of excessive wear
- ☛ Electrical wiring should not be cracked or have worn insulation
- ☛ Look at the front suspension
- ☛ Check both front brakes
- ☛ Lower and secure hood or cab

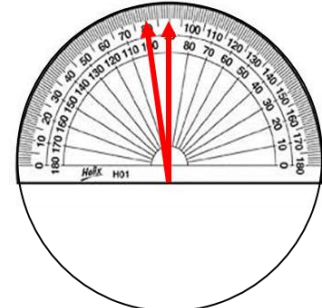
### Step 3. Start the Engine and Inspect Inside the Cab

Enter the cab and make sure the parking brake is set. Depress the clutch and place the gearshift lever in neutral. Start the engine and listen for unusual engine sounds or noises.

- ☛ Oil pressure gauge
- ☛ Ammeter/Voltmeter
- ☛ Temperature gauge
- ☛ Air pressure
- ☛ Warning lights and buzzers

Check the conditions of the controls. Look for signs of excessive looseness, sticking, binding, inadequate spring return, exterior damage, or improper setting.

When checking the steering wheel keep in mind that play of more than 10 degrees is dangerous and makes a vehicle difficult to control. Steering play is determined by the number of degrees the steering wheel can be moved before the steering tires start to turn. To accurately determine the amount of play you must be able to see the front wheels move when turning the wheel.



If a mine inspector checks your vehicle, you can be cited for any amount of excessive play.

When a vehicle is inspected on the highway, steering play of 30 degrees or more, will put the vehicle out of service.

Inspect the mirrors and windshield for cracks, dirt, illegal stickers or obstructions to view.

Make sure that all necessary emergency equipment is present, securely held in place and in working order.

- ☛ Three warning devices
- ☛ Properly charged and rated fire extinguisher
- ☛ Spare electrical fuses (On-highway requirements unless the vehicle is equipped with circuit breakers)

When the air pressure has built to the governor cut out pressure, turn off the engine, place the transmission in the lowest forward gear, release the parking brake, turn on the headlights (low beams) and four-way flashers, then leave the cab.

**SAFETY NOTE:** Always remove the truck key and place it in your pocket.

#### **Step 4. Check Lights**

Leave the cab and go to the front of the vehicle and check that the low beam headlights are working. Visually inspect the alignment. Check to see that both front flashers are operating. Reach back inside the cab and push dimmer switch. Make sure both high beams are working. Inspect, clean and adjust mirrors.

#### **Step 5. Conduct the Walk Around Inspection**

The walk around inspection is basically the same for straight trucks and combination units. The main difference is there are generally fewer axles and no fifth wheel related items to check.

Return to the cab. Turn off the headlights and four-way flashers. Turn on the parking, clearance and identification lights. Turn on the right turn signal. Leave the cab and start the walk around inspection.

As a driver goes through the inspection there are certain things to look for throughout the whole procedure such as the general condition, fresh damage, and fluid or air leaks. If there is anything unusual, or out of the ordinary, ask a mechanic or your supervisor.

Since there is a wide variation in equipment from vehicle to vehicle, this walk around sequence is broken down into areas. A driver must inspect the individual items as he comes to them. If the battery boxes are on the left side, they should be inspected when the driver is inspecting the left side. To be an efficient inspection, back tracking must be kept to the very minimum.

#### **Left Side of Cab Area**

Begin at the area of the driver's door. Look at the driver's door, door glass and door latches. Check both the "wet" and "dry" air tanks by opening the petcocks and then close the petcocks again. It is important that the "wet" tank be drained first. The "wet" tank is the first tank.

Look at the condition of the windshield. Check for damage and clean windshield if dirty. Check wiper blades for any damage and "dead" rubber.

Move to the left front wheel area and check the condition of the wheel, rim and tire looking for defects that were discussed in Part 3 of this lesson. Bearing oil or grease should not be leaking. If the vehicle has clear wheel bearing caps, check to see that the oil is up to the mark.

#### **Front of Cab Area**

When at the front of the cab, look under the front of the vehicle at the axle and steering components that could not be seen when checking with the hood up.

Look at the parking, clearance and identification lights. They should be clean, operating and the proper color. The right front turn signal light should be clean and operating.

### **Right Side of Cab Area**

Check all items on the right side of the cab, following the same procedures utilized for the left side of the cab area.

### **Right Fuel Tank Area**

The fuel tank must be securely mounted, not damaged or leaking. Fuel tanks must be held in place by the proper types of restraints. If there are signs of seepage at the tank straps, then the strap is rubbing a hole in the tank. The fuel crossover line must be secure and free of damage. Physically check to see how much fuel is in the tank.

Look under and behind the cab to check visible components. The exhaust system must be secure, not leaking, not touching any wires, fuel lines or air lines. Frame and cross members should not have any missing fasteners or any bends or cracks. Air lines and electrical wiring should be secured against snagging and chafing. The transmission should not be leaking or missing any mounting hardware or fasteners.

Pay attention to the drive shaft. Are any of the bolts loose or missing around the universal joints? Does it appear that the drive shaft has been wobbling at either end? Are any pillow blocks still secured to the frame and supporting the drive shaft? If anything looks suspicious, report it to a mechanic.

Check the hydraulic fluid level in the wet line reservoir.

### **Trailer Frontal Area**

Check the air, electrical and hydraulic connections. Are any tarp carriers securely mounted and damage free? Check that the lights and reflectors are clean and working. Are those at the front of the trailer amber in color?

### **Coupling System Area**

Pay close attention to the fifth wheel. Are there any damaged or missing parts? The fifth wheel release arm or arms must be in the latched position and any safety catch engaged.

If you are pulling a frameless dump trailer, all required pivot blocks should be securely in place.

### **Right Rear Tractor Wheels Area**

Check each wheel and tire in this area. Look at each suspension component. You must look at the inside of each wheel position to check for wheel seal leakage and brake component problems.

### **Rear of Tractor Area**

The taillights should be on and red in color. The right turn signal should be flashing and red or amber in color. Any mud flaps should be properly fastened and not rubbing the tires.

Once the obvious items are checked, look up into the back of the fifth wheel to be sure the locking jaws are around the shank of the king pin.

### **Right Side of Trailer Area**

Moving down the right side of the trailer, check that the landing gear is fully raised, has no missing parts, and is not bent or otherwise damaged.

The spare tire carrier or rack should not be damaged and should be capable of carrying any mounted tire.

Trailer side clearance lights should be clean, operating and the proper color. Clearance lights at the front and sides of the trailer or truck body should be amber in color.

The frame and cross members should not be bent, cracked, damaged, or missing.

### **Right Rear Trailer Wheels Area**

Check in this area as you did with the tractor drive axels. Some items on the far side of the trailer are easier to see from this side and should be checked now. For example, leaking wheel seals, inner edges of leaf springs, etc. Do not forget those same items on this side when inspecting from the far side.

### **Rear of Trailer Area**

Check that the taillights and clearance lights are clean, working and red in color. The right turn signal should be blinking, clean and red or amber in color. The license plate lamp should be clean and working with the license plate present, clean and secured on the highway vehicles.

Mud flaps must be present, securely fastened, not dragging on the ground or rubbing the tires. Make sure each tailgate latch is properly secured.

### **Left Rear Trailer Wheels Area**

Check all items the same way as you did on the right side.

### **Left Side of Trailer Area**

Check all items the same way as you did on the right side. Make sure that you do not overlook items on the left side that were not present on the right side.

### **Left Saddle Tank Area**

Check all items as you did at the right saddle tank area.

## **Step 6. Check the Left Signal Lights**

### **Return to the Cab**

Turn off all the lights that are now on. Place the gear shift in reverse. Activate the left turn signal and the brake lights. On most vehicles the ignition key must be turned to the on position and the parking brake set or the hand valve applied.

**Leave the Cab**

Check that the left front and rear tractor turn signals are clean and operating. Both tractor brake lights should be clean and operating. Move on back to the rear of the trailer and check that the left turn signal and both brake lights are clean and operating. Listen for the back-up alarm. With the transmission in reverse, and the ignition key on, you must be able to clearly hear the back-up alarm on vehicles that operate on mine property.

**Step 7. Check the Air Brake System**

Perform the in-cab air brake checks as explained in the next lesson.

**Complete the Pre-Operational Inspection Report Form****REPORTING YOUR FINDINGS**

Safety inspections are meaningless unless action is taken to report and correct defects. Drivers must report findings to their supervisor or maintenance department.

Make an oral report to a mechanic only when necessary. Prepare a technically accurate, written report (required by law for on highway drivers) for each vehicle operated, each day or work shift.

There are two types of written reports that may be required of you as a driver. These reports are not the same and one will not take care of the requirements for the other.

If you operate on mine property only, you must complete a pre-operational inspection report prior to operating the vehicle.

If you operate only on public highways you must complete a DOT type vehicle condition report at the end of each shift or trip.

If you operate on both mine property and the public highway you are required to complete both the pre-operational inspection report and the DOT type vehicle condition report.

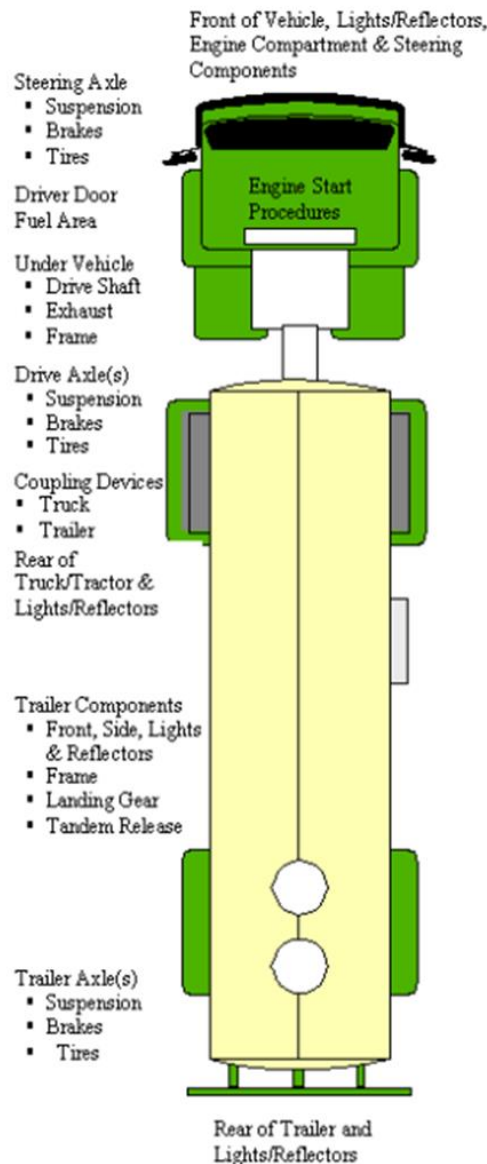
**NOTE:** Now is a good time to warn drivers that falsification of a document required by law is illegal. Fines can be assessed against driver, contractors, and mine operators.

**Pre-Operational Inspection Report (required by OMHST)**

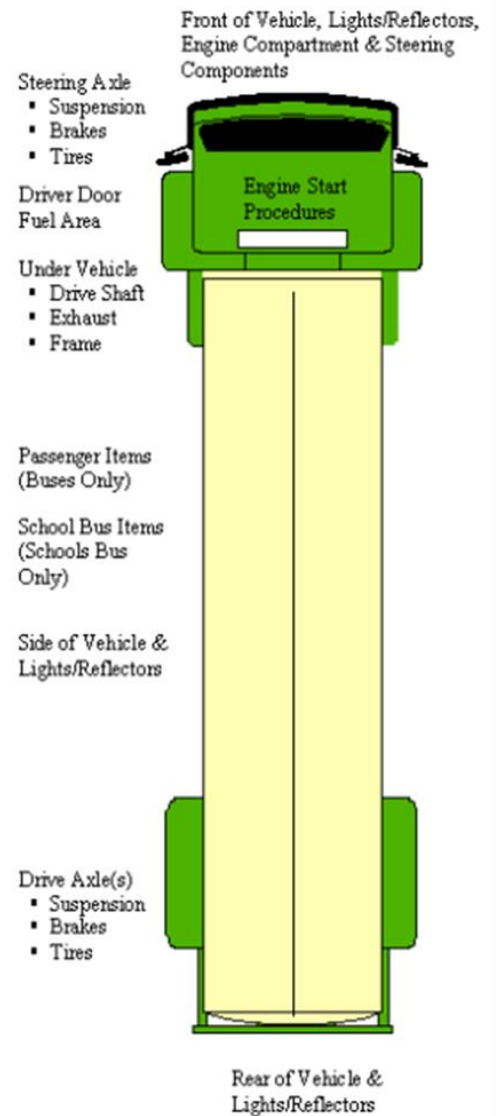
Both Federal and State mining regulations require that the operator of a vehicle on mine property prepare a written report of their pre-operational inspection. This report must be prepared before the vehicle is operated. If there are any defects that could affect the safe operation of the vehicle, they must be repaired, before operating the vehicle. A copy of the completed pre-operational

**CDL Vehicle Inspection Memory Aid**

**Combination Vehicles**



**Straight Truck or Bus**





inspection must be kept in the vehicle for 30 days while it is operated on mine property.

**Vehicle Condition Report** (required by U.S. DOT & PSC)

Vehicle Condition Reports are required by law for companies operating vehicles on public highways. There are many versions of vehicle condition reports based on the one recommended by DOT, but the OMHST pre-operational form is not one of them. This report serves as daily (or shift) record of driver's findings. While DOT regulations require the same pre-operational (or pre-trip) inspections, they do not require a written report. The written report for on-highway vehicles is required to be completed at the end of the trip (or shift).

One copy of the report is to be kept in company files for a minimum of three months. One copy is to be kept on the vehicle (power unit) until the next report is completed. This is to alert the next driver to any defects or problems reported by the last driver, which should have been repaired.

Before operating a vehicle on highway, a driver is required to review the previous driver's report. After reviewing the previous driver's report, the next driver must follow one of two different procedures.

**If No Defects Are Listed by the Previous Driver**

Keep the previous driver's inspection report in the cab of the vehicle until you complete a new one at the end of your shift or trip. No other signatures are required.

**If Defects Are Listed by the Previous Driver**

You must sign the previous driver's report as the reviewing driver, if and only if, someone has signed that needed repairs were made to the vehicle. It is illegal to drive the vehicle on the highway unless the person repairing the vehicle has signed the inspection report.

There is nothing in the regulations that requires the three signatures on a DOT inspection report to be different persons. You may drive a vehicle today, write up a defect, repair the defect, and drive the vehicle the next time it is driven. In this case, you would be the reporting driver, the person making the repair, and the reviewing driver.

If someone else has already signed the report as making needed repairs to a vehicle that you are going to drive, you as the reviewing driver are not certifying the repairs. You are certifying that you have reviewed the report, are aware that the previous driver listed a defect and that someone has signed the report that the repairs have been made.

When someone else has signed the previous inspection report, that needed repairs have been made, you must still do your own full pre-operational inspection.

**AIR BRAKE INSPECTION  
AND ADJUSTMENT TRAINING PROGRAM**

**TRAINING MANUAL**

**WEST VIRGINIA OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING**

## AIR BRAKE INSPECTION AND ADJUSTMENT (Classroom)

### **Overview**

**Prerequisites:** Vehicle Inspection Lesson

### **PURPOSE:**

The purpose of this lesson is to communicate the steps for inspecting an air brake system and S-cam air brake adjustment.

### **MATERIALS:**

#### Student Material

Training Manual

#### Instructional Materials

Powerpoint Presentation

### Content

1. Fundamentals of Air Brakes
2. Air Brake Components
3. Air Brake Inspection Procedures
4. S-cam Air Brake Adjustment
5. Anti-Lock Brakes

## AIR BRAKE INSPECTION AND ADJUSTMENT

### **PURPOSE**

The purpose of this unit is to enable the students to understand the basic components of an air brake system and their interrelation in the proper functioning of the brakes. The student must also know how to perform the basic tests for system integrity and how to properly adjust the slack adjusters.

### **OBJECTIVES**

#### **Performance Objectives**

Students must be able to:

- Inspect and to make a determination of the condition of various critical brake subsystems, including the air reservoirs, compressor, hoses, controls, and slack adjusters.
- Perform inspections in a regular systematic sequence that is accurate, uniform, and time efficient.
- Recognize warning signs of a subsystem or complete brake failure while operating.
- Make sure that all moisture and oil are expelled from the air tanks daily.
- Properly adjust slack adjusters.
- Determine when a vehicle is unsafe to operate.

#### **Knowledge Objectives**

Students must know:

- A systematic procedure to assure a rapid and complete inspection of the brake system.

#### **Skill Objectives**

The student must be able to:

- Inspect the air brake system
- Adjust slack adjusters and drain air reservoirs

#### **Attitude Objectives**

Students must believe:

- That their lives and those of others depend on maximum brake efficiency
- It is the driver's obligation to assure that the brakes are properly inspected and maintained when necessary

## FUNDAMENTALS OF AIR BRAKES

There are certain basic physical laws that affect the performance of any moving vehicle and its braking system. These are laws of nature that are present no matter how great the skills of the driver or the design of the vehicle. The first principal of a moving vehicle is that it will continue to move in the direction it is going until it is acted upon by another force. As the weight of a vehicle increases, it will require more force to cause it to begin moving, continue to move, or to cause it to stop. The second law is that you cannot destroy energy. It can only be converted to another form of energy.

In the mining environment it is not at all unusual for trucks to have engines of 400 horsepower or more. If a truck requires the energy of 400 horsepower to accelerate to 60 miles per hour in 60 seconds, then it would require brakes that can absorb the energy of 400 horsepower to stop it from 60 miles per hour in 60 seconds. This, of course, would be ridiculous stopping time and distance. Therefore, if this same truck is traveling 60 miles per hour and takes six seconds of brake application to stop, this requires brakes that can absorb the heat energy equal to 4,000 horsepower. On a 6-axle unit with 12 brakes this would require each brake to be able to absorb the heat energy of 316 horsepower. On a 5-axle unit with 10 brakes this would require each brake to be able to absorb the heat energy of 400 horsepower.

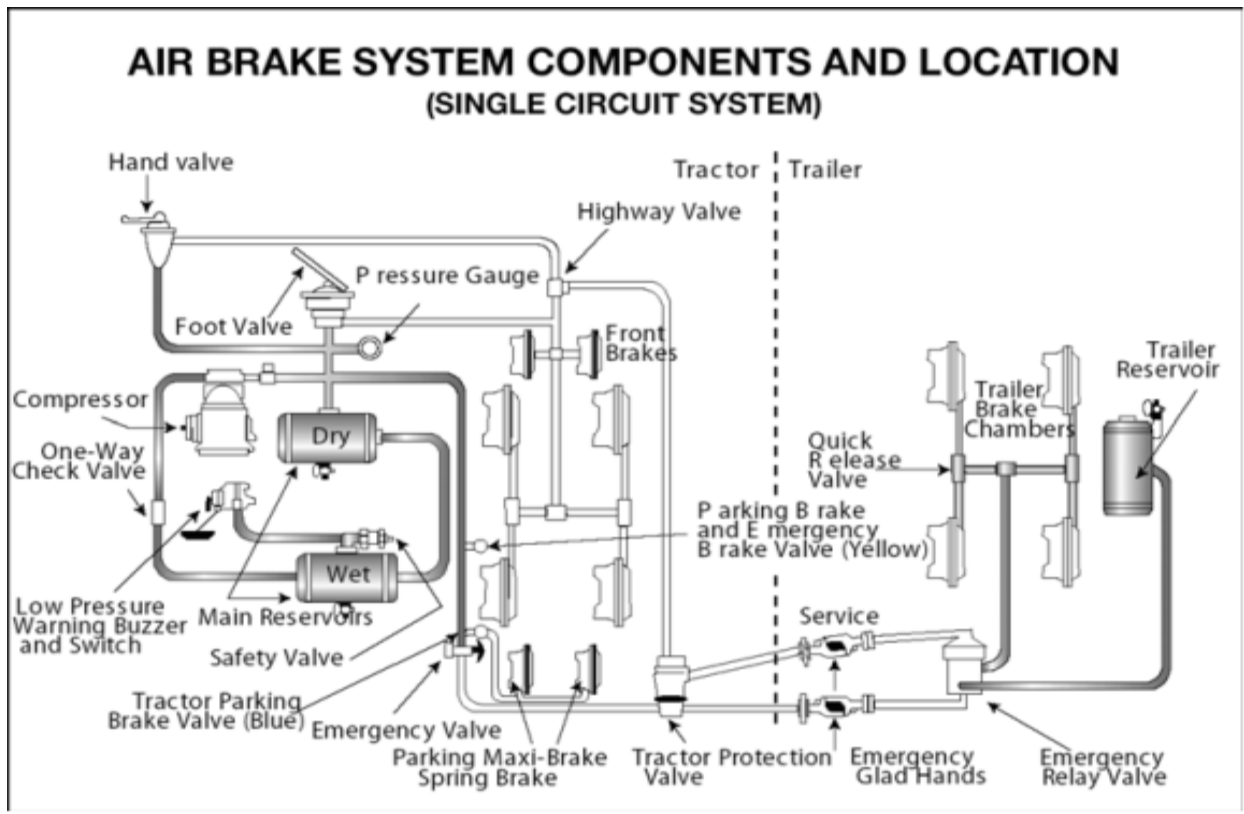
As weight and speed increases the heat energy that the brakes must absorb increases. If weight doubles, then the stopping power required doubles. If speed doubles, then the stopping power required increases by a factor of four. If the speed and weight both double, then it would take eight times the stopping power originally needed to stop the vehicle. As an example, an 80,000-pound vehicle traveling 60 miles per hour requires eight times the stopping power of a vehicle weighting 40,000 pounds traveling 30 miles per hour.

Brakes stop a vehicle by converting the energy of motion into heat. Forcing the brake shoes against the drum creates large amounts of heat. The brake drum must be able to absorb the heat from this friction and in turn dissipate it to the atmosphere.

### 121 AIR BRAKES

In 1975, Federal Motor Vehicle Safety Standard (FMVSS) 121 became effective as the minimum requirements for truck, trailer, and bus air brake systems. Included in this standard was a requirement for anti-lock brakes that was dropped in 1978 because of reliability problems. The rest of the standard remains in effect. Two of the biggest changes mandated by FMVSS 121 were the requirements for a dual circuit air system and spring brakes on at least one axle of each unit. Modern air brakes are comprised of three systems.

1. The service brakes that are controlled by the foot valve for normal brake applications.
2. The parking brake system that engages the brakes on at least one axle of each unit.
3. The emergency brake system that activates in the event of an air pressure loss.
  - The emergency brakes can also be activated by a dash mounted control valve.



### **Dual Circuit Air Brake Systems**

Each power unit is required by FMVSS 121 to have a dual circuit air brake system. A dual circuit system will allow part of a vehicle's brakes to operate if one circuit fails. It also can provide some air to the failed circuit to improve driver control in an emergency. Most power units have the steering axle brakes on one circuit and the drive axle brakes on a second unit. Power units with 121 brakes are easy to recognize. There will either be two air pressure gauges, one for front, and one for rear, or there will be one gauge with two needles. The two-needle gauge will generally have one green and one red needle. Some persons think these two needles represent the emergency and service brake systems. This is not correct. The red needle normally represents the front circuit and the green needle the rear circuit.

### **Spring Brakes**

FMVSS 121 requires that all air brake equipped vehicles have parking and emergency brake systems powered by an energy source that cannot leak away. This is accomplished by using spring brakes on at least one axle of each unit. Spring brakes are called several different names such as maxi-brakes, piggyback brakes, anchor locks, etc. When the parking brake is activated or there is a loss of air pressure to the spring brake, the spring brake will no longer be held back by air pressure and it will engage the brake.

### **Foundation Brakes**

Foundation brakes are the brakes found at the end of the axles. These are the brakes on which all three 121 brake systems rely for stopping power. If the foundation brakes are not properly

maintained and adjusted none of the three 121 brake systems will work. There is normally no back up or fail safe for the foundation brakes. Everyone that operates a vehicle with air brakes must understand that the emergency braking system built into the 121-air brake system will not work if the foundation brakes fail.

There are several causes of foundation brake failure. Most accident investigations reveal two or more problems working together to cause the foundation brakes to fail. When a foundation brake failure is combined with driver error, the results often include serious injury or death. For example, trying to downshift while going down a steep grade with no brakes left. Causes of foundation brake failures include:

- ☛ Slack adjusters beyond the readjustment limit
- ☛ Brake shoes worn to less than  $\frac{1}{4}$  of an inch
- ☛ Brake shoes saturated with grease or oil
- ☛ Brake drums worn too thin to absorb and dissipate the heat generated by the brake shoes.

### Operating in the Mine Environment

Most trucks being operated in the mining environment that are equipped with air brakes have a very large drawback. These trucks were primarily designed to operate on the highway. Factors considered when designing a truck for on-highway use, do not always reflect the conditions under which the truck will operate in the mine environment. To say that mining is a severe service environment compared with interstate highway operation is a gross understatement. Some factors that are normal for mining but not for highway operations include:

- ☛ Gross vehicle weights at or above the manufacturer's rating
- ☛ Roads with grades greater than seven percent
- ☛ Irregular unpaved surfaces
- ☛ Large amounts of abrasive dust (watered roads can be worse)
- ☛ Short cycle times between loaded and empty

It is very easy to take a truck beyond its intended design limit when operating in the mining environment. In addition to good driving skills, you must have the skills needed to easily recognize equipment problems that endanger you and your co-workers.

## **AIR BRAKE COMPONENTS**

The following are the major components of a 121-air brake system with a brief explanation of their function.

- ☛ Air Compressor – provides energy to power the brake system. It is driven by the engine, either by belt or gear drive.

NOTE: Large amounts of oil in the air tanks indicate the compressor rings are worn out. If allowed to continue, oil will eventually spread to all the lines and control valves, hindering brake system performance.

- Compressor Governor – maintains reservoir air pressure by working with the compressor unloading mechanism.

NOTE: Most air brake systems require 115-125 pounds of pressure to operate properly. If the cut-out pressure is too low it may indicate a governor that needs adjusted or replaced.

- Safety Valve – prevents excessive air pressure build up. Usually it is set to release any pressure above 150 psi to the atmosphere.
- Air Dryers and After Coolers – designed to remove water and oil from the air system before it reaches the air tanks.
- Primary Air Tank – this is the first air tank to be supplied by the compressor. It in turn will provide air to the secondary tanks. This tank is also known as the wet tank.
- One-Way Check Valves – allow air to flow from the primary tank to the secondary air tanks only. Air is not allowed to flow from the secondary tank back to the primary tank.
- Secondary Air Tank – each power unit must have at least two secondary air tanks. One tank will supply the front brake circuit and one the rear brake circuit.

NOTE: Some power units will have one tank that is internally divided into two separate tanks. Some power units may have a third secondary air tank to provide an air supply for air powered accessories.

- Foot Valve – a foot operated air pressure regulating valve. It functions as both an inlet valve and an exhaust valve to allow a smooth application and release of the service brakes.
- Hand or Trailer Control Valve – a hand operated valve that applies the trailer's service brakes without engaging the tractor's brakes. Never to be used as a parking brake.
- Park Control Valve – a dash mounted control valve that supplies or cuts off the air supply to the truck or tractor and trailer parking brakes. (yellow knob)

NOTE: Trucks will generally have only one dash mounted parking brake control valve. Tractors will have either two of three control valves.

- Tractor Parking Valve – a dash mounted control valve that supplies or cuts off the air supply to the tractor parking brakes. When air is supplied, the parking brakes are released. When the supply of air is cut off, the parking brakes will engage. This valve will not control the trailer parking brakes on combination vehicles. (blue knob)
- Air Pressure Gauge – a gauge that indicates the amount of air pressure in the air supply tanks.

NOTE: Air brake equipped vehicles built to FMVSS 121 must have either a 2-needle air gauge or two separate air gauges. One needle or gauge represents the front brake system of the truck or tractor and the second needle represents the rear system of the truck or tractor.



- Air Application Gauge – a gauge that indicates the amount of air pressure being applied to the brakes.
- Low Air Pressure Warning Device – a visible warning device, mandated by law, to warn the vehicle operator that air pressure had dropped below 60 pounds per square inch.

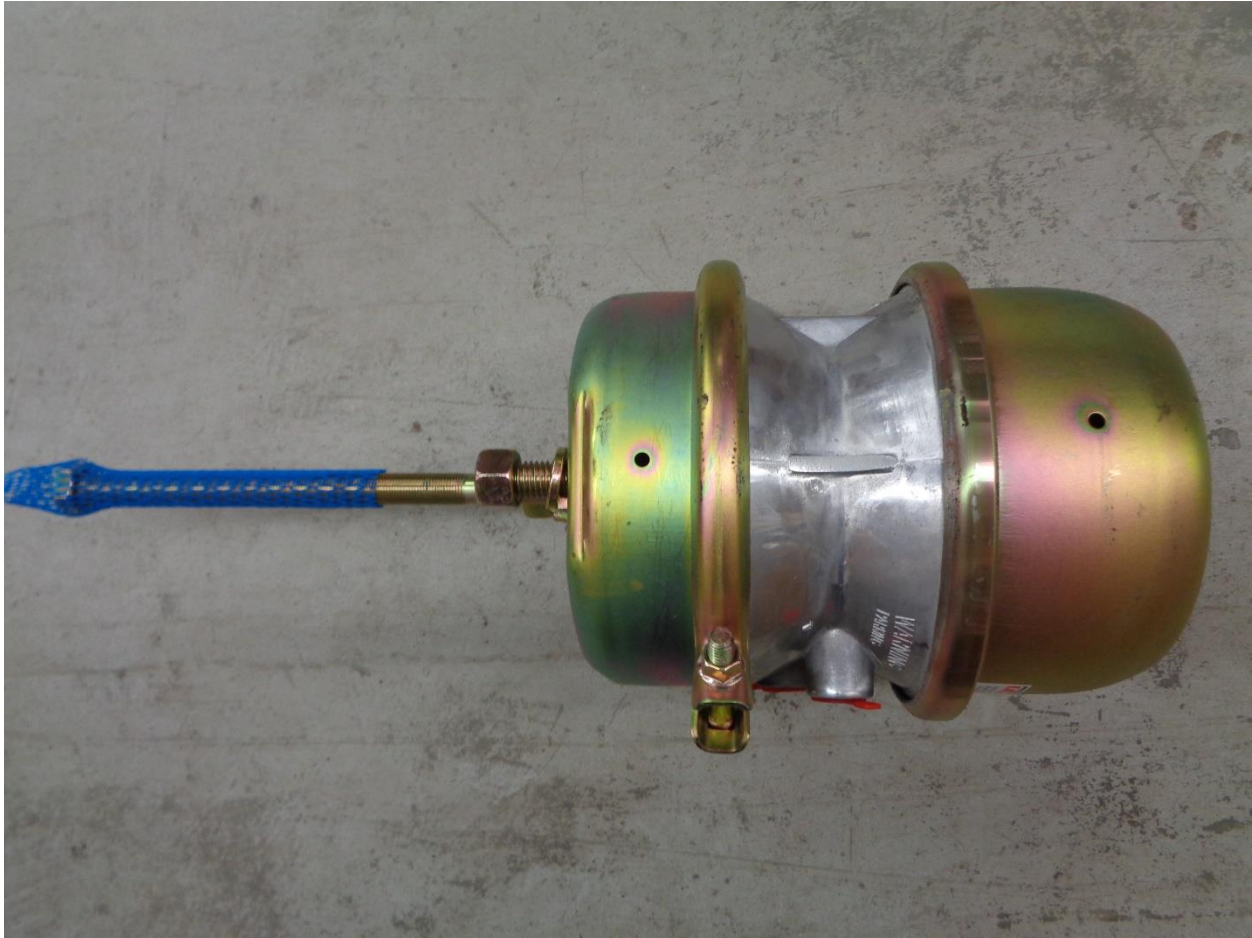
NOTE: An audible warning device, by itself, does not meet DOT requirements. A visible one is required. On 121 brake systems both circuits have their own air pressure sensors.

- Quick Release Valves – air control valves located near the brakes that allow the brakes to release without the exhaust air returning all the way to the foot valve or hand valve.
- Relay Valves – air control valves located near the brakes that apply air to the brakes. These valves act as a remote foot during a brake application. If air had to travel from the foot or hand valve all the way to the individual brakes, smooth brake applications would be impossible. The relay valve senses an air pressure signal sent through a small diameter line to know when and how much pressure to apply.
- Single Diaphragm Brake Chambers – a canister shaped device mounted on the axle near the brake. Inside the chamber is a flexible rubber diaphragm (pancake) that rests against a metal plate that is attached to a pushrod. When air pressure from the foot or hand valve is applied, the diaphragm pushes the metal plate and pushrod to activate the brake.

NOTE: All steering axle brakes have single diaphragm brake chambers. With on-highway vehicles, the chamber must be in place, working, and the brake adjusted within the set limits.

- Dual Diaphragm Brake Chambers – also known as spring brakes, maxi-brakes, anchor locks or piggyback brakes. Dual diaphragm brake chambers are like single diaphragm brake chambers with a second canister attached to it. The second canister also has a rubber diaphragm in it. This second diaphragm is used to compress a strong steel spring in order to release the parking brakes. Federal vehicle standards require that emergency and parking brakes be powered by an energy source that cannot leak away. This steel spring provides the power or energy source to operate both the emergency and parking brakes.

NOTE: Now would be a good time to state your company policy about drivers working on spring brakes. Any person allowed to work on spring brakes must be fully aware of the dangers associated with these powerful springs.

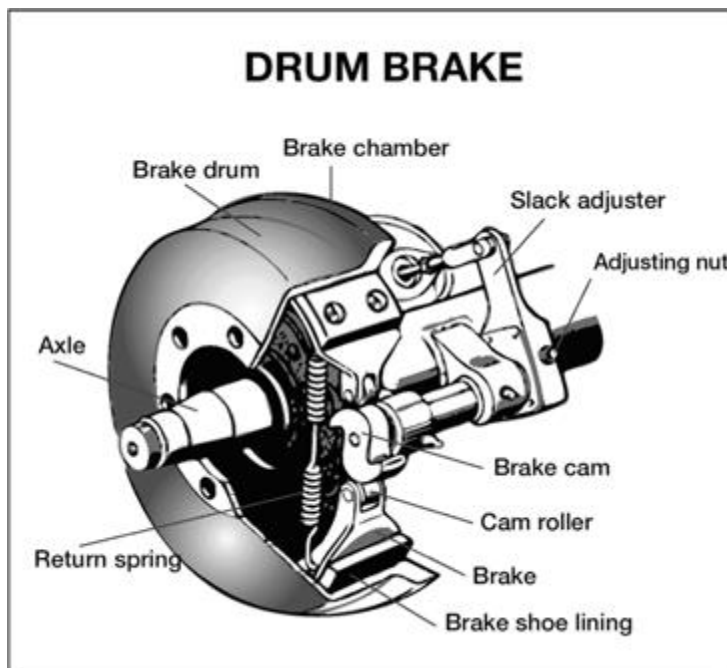


- Slack Adjusters – the device that links the brake chamber pushrod to the brake camshaft. It converts the straight line motion of the pushrod to a turning motion at the camshaft. The adjustment of the slack adjuster determines the amount of clearance between the brake shoe and brake drum when the brakes are not applied. When the proper clearance between brake drum and brake shoe is maintained, brake chamber pushrod travel is kept within allowable limits when the brakes are applied.
  - Manual Slack Adjusters – Slack adjusters that do not adjust themselves.
  - Automatic Slack Adjusters – Slack adjusters that sense the clearance between the brake shoe and brake drum and decreases the clearance if there is too much.
- S-Cams – the shaft that has a slack adjuster attached to the splined end and an S-shaped cam forged into the end that goes into the brake drum. Then this camshaft is rotated, it will move the roller equipped end of the brake shoe, pushing the brake lining against the brake drum.

- Brake Linings – the actual friction surface of the brake shoe or pad that contacts the brake drum when the brakes are applied.
- Brake Drums – the cast metal, drum-shaped component found at the ends of the axle. Brake drums must be thick enough and strong enough to absorb the heat generated when the friction lining engages the drum. Brake drums must also be able to dissipate this heat to the atmosphere.

### Engine Retarders

There are several brands of retarders available for truck engines. The most common is the Jake Brake that creates braking power by altering the exhaust valve timing. When the valve timing is changed, the engine is turned into an air compressor. By making the engine an air compressor, it



is absorbing energy instead of providing it.

Inspecting a Jacobs type engine retarder during a pre-operational inspection consists of:

- Checking wires while doing the under hood as part of the pre-operational inspection.
- Checking the condition of the dash controls
- Do not turn the retarder on and off while the engine is idling. This can cause engine damage.

**INSTRUCTOR'S NOTE:** Now is a good time for a quick review of Jake Brake

Safety.

1. Jake Brakes are not a substitute for brakes.
2. A Jake Brake helps and extends the life of service brakes.
3. Jake Brake can create traction problems when traction is reduced by rain, snow, ice, loose gravel, etc...
4. Jake Brakes can make a driver too confident about stopping ability
5. Jake Brakes are not a toy to use in scaring or annoying other people

## **AIR BRAKE INSPECTION PROCEDURES**

Any complete pre-operational inspection includes a thorough inspection of the braking system. It is a matter of life and death for vehicles operating in the mine environment. Your life and the lives of your co-workers may depend on your ability to recognize braking system defects.

When performing the seven-step inspection procedure you will be inspecting the braking system as part of:

Step 2 – Under the hood

Step 5 – While performing the walk around, and

Step 7 – The in-cab air brake checks

Many inspection procedures published in the past were based on cab-over-engine type vehicles. If inspecting a conventional type vehicle with an engine hood, take advantage of the better access allowed by raising the engine hood.

### **Under Hood and Walk Around Checks**

You must inspect the whole braking system. This includes giving each wheel position its own brake inspection and adjustment. Look at the following brake components.

- Air Compressor – the compressor must be securely mounted to the engine. If it is belt-driven, check the belt for signs of fraying, cracking and looseness.
- Brake Lines – look for signs of cracking, fraying and rubbing. Run your hand over the air line. This will let you feel any rubbing or fraying that you cannot see. Move the air lines with your hand and listen for air leaks. Be sure to check the airlines going to the foot valve and the air compressor as well as the lines going to each individual brake.
- Air Tanks – drain the air tanks as part of your inspection. Drain the wet tank first. The tank that is first to get air from the compressor is the wet tank.

NOTE: Draining the wet tank first keeps water and oil from being drawn over into the dry tank and then into the brake system.

- Brake Drum – check for cracks and signs of grease leaking into the inside of the drum. Remember that it is the grease leaks that you see from the inside or back of the wheel that are so dangerous.
- Brake Linings – there must be a least  $\frac{1}{4}$  inch of lining at the center of the shoe for on-highway use. If hauling heavy loads, this is normally not enough lining. The brake will rapidly overheat and fade. Keep in mind that the center of the lining is normally the thickest part. If there are backing plates, you must have a flashlight to see the lining through the small inspection hole. If there is no backing plate on the brake assembly, you

can also check to make sure the lining is not breaking off in pieces or separating from the shoe.

NOTE: On-highway inspections will basically rely on the ¼ inch lining rule. Mine inspectors are not bound by a particular thickness of lining. They are required to use their best judgement to determine if the lining is adequate for the haul being performed on mine property.

- Brake Chamber – make sure the chamber is securely mounted and not missing any fasteners. The large clamp or clasps around the outside diameter of the brake chamber must be tight and not dented or otherwise damaged. There must be a boot or bushing in place where the pushrod exits the brake chamber. If this is not present, the chamber will eventually fail from water and dirt entering the chamber and interfering with its operation.
- Slack Adjusters – in addition to checking the adjustment which we will cover later, the slack adjuster must be held securely in place. Check the clevis pin and cotter key on the brake chamber end and make sure the large C-clip is present and securely seated at the camshaft end of the adjuster.
- Camshaft and Bushings – the camshaft must be held in close alignment by its bushings. If the bushings are badly worn, it will allow the camshaft to deflect when the brakes are applied. This will greatly diminish the stopping power of the brake.

### In-Cab Brake Checks

The last part of inspecting an air brake system is the in-cab series of checks. These checks are just as critical as inspecting each of the brakes. These are also the least likely checks to be performed by the driver. Your brakes, chambers and slack adjusters may be in perfect condition, but they are useless, if the system that applies the brakes does not work.

Then in-cab brake checks allow you to detect problems that may not be visible during the walk around inspection. The in-cab checks can also help isolate which brake system is malfunctioning.

When you begin your in-cab inspection, the engine should be off, the transmission in gear, and the parking brakes released.

- Check 1** Is the air pressure gauge indicating that an air loss occurred while the walk around inspection was being done? The vehicle should not have lost more than 5-10 pounds of air pressure. If the loss of air was greater than 5-10 pounds you should have been able to hear an air leak during the walk around. If you are unable to hear the leak, close attention should be given during the following checks.
- Check 2** Apply the brakes using the foot valve. Time the rate of air loss after the initial pressure drop of application.

**Maximum Loss Rate**

Straight Truck	3 pounds per minute
Tractor Trailer	4 pounds per minute

If the rate of loss is equal to or less than the limits go on to Check 3. If the loss is more than the limits do the following.

Straight Truck – if both gauge needles drop at the same rate, then there is a major malfunction in one of the application or control valves. If only the red or front gauge needle drops, then the leak is in the front brake system. If only the green or rear gauge needle drops, then the problem is in the rear brake system.

Tractor Trailer – if both gauge needles drop at the same rate, then there is a major malfunction in one of the application or control valves, or there is a leak in the trailer. Apply the hand valve by itself. If there is a pressure drop now, then the leak is in the trailer service brakes. If there is no leak when applying the hand valve, set the trailer parking brakes. Apply the foot valve again. If there is no air loss, then the leak is in the trailer emergency system. If the air loss continues with the trailer parking brake set, the leak is in the tractor.

- Check 3** Test the low air pressure warning device by turning the ignition key to the on position and pumping the foot valve. The visible warning must come on when the air pressure gets down to 60 pounds.
- Check 4** Test the emergency brakes by continuing to pump the foot valve. The emergency brakes must activate, and the control knobs pop out of the dash by 40 pounds pressure.
- Check 5** Start the engine. Air pressure should be back to cut out pressure (120-125 lbs.) within four minutes. The low air warning device should shut off at 60 to 65 pounds pressure.

**S-CAM AIR BRAKE ADJUSTMENT**

We will describe automatic versus manual slack adjusters and two methods for adjusting slack adjusters in this section. The first method for adjustment is the two-person method that is the most accurate method. The second will be the one-person method, which is quick and easy, but not quite as accurate. There is one aspect of adjusting the brakes that is the same no matter which method is used and cannot be overstated, **CHOCK THE WHEELS**, both front and rear. It is against both OMHST regulations and a sign of gross stupidity to attempt to adjust the brakes without first chocking the wheels. Check the adjustment of each slack adjuster as you come to it during the walk around inspection. Adjust the brakes as necessary.

### **Adjusting Automatic Slack Adjusters**

As their name infers, automatic slack adjusters should automatically stay in adjustment. In the event an automatic slack adjuster needs adjustment, there is probably a problem more significant than just improper adjustment. Normally one of two things have happened. Most often the slack adjuster is too severely worn or otherwise defective and cannot hold an adjustment. Sometimes, the problem is an improper installation of the automatic slack adjuster.

If you have an automatic adjuster that is out of adjustment and you cannot get it replaced, be very careful adjusting it. You must know if the automatic slack adjuster has an anti-reverse device that must be removed to properly adjust the slack adjuster. The most common example of this is the Rockwell Paymaster automatic slack adjuster. You must also know that any adjustment you make to an automatic slack adjuster will not hold for very many brake applications. It may only hold for as few as two or three applications.

Automatic slack adjusters are required on any vehicle built for on-highway use after October 20, 1994.

### **Two-Person Adjusting Method for Manual Slack Adjusters**

With one person in the cab of the vehicle, the second person is under the vehicle doing the actual adjustment. The engine must be off, the transmission in low gear and the parking brakes released.

#### Required Material:

- Proper size wrench (generally a 9/16")
- A rag
- A small ruler

#### Procedure:

- Double check that the wheels are chocked
- Mark the brake pushrod where it exits the brake chamber. This can be done by just wiping the dirt off or scratching with a wrench.
- Have the person in the cab apply the brakes. Measure the distance that the pushrod had traveled out of the brake chamber.
- If the pushrod had traveled more than  $\frac{3}{4}$  of an inch, adjust this brake.
- Have the person in cab release the brake.
- Wipe any dirt, grit, or grease from around the lock ring.
- Push in on the lock ring and tighten the adjusting nut until the shoes contact the drum.
- Back the adjusting nut off  $\frac{1}{4}$  to  $\frac{1}{2}$  of a turn.
- Have the person in the cab reapply the brakes. Measure the distance that the pushrod has traveled out of the brake chamber.
- The distance should now be  $\frac{3}{4}$  of an inch or less.

- Make sure that all steering axle brakes are at the same measurement and that all non-steering axles are at the same measurement.
- The adjuster nut lock ring must come back out to the locking position. The slack adjuster will not hold proper adjustment if it does not.

### **One-Person Adjusting Method for Manual Slack Adjusters**

With the wheels chocked front and rear, the key removed from the ignition, and the transmission in low gear, release the parking brake.

Required Material:

- Proper size wrench (generally a 9/16")
- A rag

Procedure:

- Double check that the wheels are chocked
- Wipe any dirt, girt or grease from around the lock ring
- Push in on the lock ring and tighten the adjusting nut until the shoes contact the drum
- If there is no backing plate, tap the brake drum with the wrench. You should hear a dull sound.
- Back the adjusting nut off ½ of an inch or less
- Pull on the slack adjuster by hand or with a bar
- The distance should now be ½ of an inch or less
- If there is no backing plate, tap the drum with your wrench. You should hear a ringing sound. If it is a dull sound, the shoe has not cleared the drum, or the drum may be cracked.
- Make sure that the amount of pushrod you can pull from the brake chamber is the same from side to side on each axle. Some drivers prefer a little bit more pushrod travel on the steering axle brake chambers. This allows the rear brakes to activate a little bit before the steering axle brakes.
- The adjuster nut lock ring must come back out to the locked position. The slack adjuster will not hold proper adjustment if it does not.

## **ANTI-LOCK BRAKES**

The United States Department of Transportation has proposed that anti-lock brakes again be required equipment on large trucks, buses and trailers. At this time, it has not yet been made mandatory and no implementation dates have been set.

From 1975 to 1978 new trucks, tractors, buses and trailers were required to have anti-lock brake systems under Federal Motor Vehicle Safety Standard 121. These were not particularly good anti-lock brakes. They were not always reliable and, in some cases, made stopping safely very difficult.



For those drivers that operate both on-highway, there is a good chance that you may encounter anti-lock brakes on any vehicle that is a 1995 model or newer. Many truck manufacturers are making anti-lock brakes standard equipment before they are required by law.

The new anti-lock systems are a total redesign and carry over little but the concept of anti-lock braking from the old system. Controlled studies of 200 anti-lock equipped on-highway trucks and tractors have been very successful. Here are some of the major component differences.

**Old System**

Stamped Sensor Rings  
Automotive type

Wire connectors

Two position modulators  
Valve (apply, release)

**New System**

Machined Sensor Rings

Military Specification

Wire connectors

Three position modulators  
Valve (apply, hold, release)

How anti-lock brakes will perform on vehicles that operate both on mine property and the highway is not currently known. There are potential problems with the dirt, dust and often wet operating environment associated with mining. There are also potential compatibility problems with older trailers that do not have anti-lock brakes. These compatibility problems could easily arise since anti-lock equipped vehicles need a steady brake pedal application as opposed to an on and off the pedal type braking application. Until there are a number of anti-lock equipped vehicles operating in the mine environment for a period of time, we will not know the answer to these questions.

## **OPERATIONS AND COMMUNICATIONS**

### **TRAINING MANUAL**

**WEST VIRGINIA OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING**

## OPERATIONS AND COMMUNICATIONS (Classroom)

### Overview

**Prerequisites:** Vehicle Inspection Lesson

**PURPOSE:**

The purpose of this lesson is to identify the proper procedures for operating the truck, and also discuss communication techniques that insure the safety of persons inside and around the vehicle.

**MATERIALS:**

Instructional Aids

Powerpoint Presentation, Operational and Haulage Videos

Student Material

Training Manual

Instructor Materials

Training Manual (the instructor should have copies of mine safety and highway safety regulations available for reference)

Instructor Manual

Content

1. Preparing for Operations
2. Basic Control of Your Vehicle
3. Communications
4. Controlling Speed
5. Managing Space
6. Driving at Night
7. Mountain Driving
8. Driving Fitness

## OPERATIONS

### **Preparing for Operations**

After the proper pre-operational inspection has been made, preparations can now be made for operating the truck.

#### **Parking:**

Whenever possible, the truck should be backed into a parked position and the park brake should always be set and/or wheels chocked. By properly parking the truck during idle periods, you will reduce the hazards and increase the visibility when the truck returns to service by being able to pull forward.

#### **Blind Spots:**

All vehicles have certain areas around them that are difficult to see. This is especially true with heavy trucks. The size of the blind spots can vary from driver to driver as well as different trucks. Many trucks have available numerous optional windows, mirrors, and other safety devices which may reduce the size of the blind spots.

Whenever you have left your truck, before resuming operation, always walk around the entire truck and observe if people or other objects are near.

**CAUTION:** In some areas around mining operations and loading facilities, you may not exit the truck cab. In many areas of mining operations, you may also be required to wear a hard hat and other safety apparel. Becoming familiar with these requirements could prevent injuries and other problems.

#### **Starting:**

When starting the truck, always allow a sufficient warm-up period before operating. This will vary according to outside temperatures and conditions as well as differences in trucks. Become thoroughly familiar with the truck's instruments and controls. Always make sure all windows and mirrors are clear before moving the truck.

### **Get in Vehicle**

- ☛ Turn off lights not needed for driving
- ☛ Check for all required papers, trip manifest, permits etc.
- ☛ Secure all loose articles in the cab (they might interfere with operation of the controls or strike you in the event of a crash).
- ☛ Start the engine

### **Test for Hydraulic Leaks**

If the vehicle has hydraulic brakes, pump the brake pedal three times. Then apply firm pressure to the pedal and hold for five seconds. The pedal should not move. If it does, there may be a leak or other problem. Get it fixed before driving.

### **Test Parking Brake**

- ☛ Fasten seat belt
- ☛ Allow vehicle to move forward slowly
- ☛ Apply parking brake
- ☛ If it does not stop vehicle, it is faulty – get it fixed

### **Test Service Brake Stopping Action**

- ☛ Go about five miles per hour
- ☛ Push brake pedal firmly
- ☛ “Pulling” to one side or the other, can mean brake trouble
- ☛ Any unused brake pedal “feel” or delay in stopping

### **Inspections During a Trip**

- ☛ Instruments
- ☛ Air pressure gauge (if you have air brakes)
- ☛ Temperature gauges
- ☛ Pressure gauges
- ☛ Ammeter/voltmeter
- ☛ Mirrors
- ☛ Tires
- ☛ Cargo and cargo cover

If you see, hear, smell or feel anything that might mean trouble, check it out.

### **After Trip Inspection & Report**

You may have to make a written report each day on the condition of the vehicle(s) you drove. Report anything affecting safety or possibly leading to mechanical breakdown.

The vehicle inspection report tells the vehicle owner about problems that may need fixing. Keep a copy of your report in the vehicle for one day. That way, the next driver can learn about any problems you have found.

### **Basic Control of Your Vehicle**

To drive a vehicle safely, you must be able to control its speed and direction. Safe operation of a commercial vehicle requires skill in:

- ☛ Accelerating
- ☛ Backing Safely

- ☛ Shifting Gears
- ☛ Braking

Fasten your seat belt when on the road. Apply the parking brake when you leave your vehicle.

**Accelerating** – Do not roll back when you start. You may hit someone behind you. Partly engage the clutch before you take your right foot off the brake. Put on the parking brake whenever necessary to keep from rolling back. Release the parking brake only when you have applied enough engine power to keep from rolling back.

Speed up smoothly and gradually so the vehicle does not jerk. Rough acceleration can cause mechanical damage. When pulling a trailer, rough acceleration can damage the coupling. Speed up very gradually when traction is poor, as in rain or snow. If you use too much power, the drive wheels may spin. You could lose control. If the drive wheels begin to spin, take your foot off the accelerator.

**Backing Safely** – Because you cannot see everything behind your vehicle, backing is always dangerous. Avoid backing whenever you can. When you park, try to park so you will be able to pull forward when you leave. When you must back up, here are a few simple safety rules:

- ☛ Look at your path
- ☛ Back slowly
- ☛ Back and turn toward the driver's side whenever possible
- ☛ Use a helper whenever possible

**Look at Your Path** – Look at your line of travel before you begin. Get out and walk around the vehicle. Check your clearance to the sides and overhead in and near the path your vehicle will take.

**Back Slowly** – Always back as slowly as possible. Use the lowest reverse gear. That way you can more easily correct any steering errors. You also can stop quickly if necessary.

**Back and Turn Toward the Driver's Side** – Back to the driver's side so you can see better. Backing toward the right side is very dangerous because you cannot see as well. If you back and turn toward the driver's side, you can watch the rear of your vehicle by looking out the side window. Use driver-side backing-even if it means going around the block to put your vehicle in this position. The added safety is worth it.

**Use a Helper** – Use a helper when you can. There are blind spots you cannot see. That is why a helper is important.

The helper should stand near the back of your vehicle where you can see the helper. Before you begin backing, work out a set of hand signals that you both understand. Agree on a signal for "stop".

**Shifting Gears** – Since many accidents have been directly or indirectly linked to improper changing of gears and/or failure to maintain speed and control, it is of vital importance for the driver to become experienced in methods of proper shifting and when to apply them.

To become a safe operator, it is always extremely important to maintain proper control of your vehicle and avoid being exposed to situations where harm might result.

Correct shifting of gears is important – If you cannot get your vehicle into the right gear while driving, you will have less control.



### **Manual Transmissions**

Basic Method for Shifting Up. Most heavy vehicles with manual transmissions require double clutching to change gears. This is the basic method:

1. Release accelerator, push in clutch and shift to neutral at the same time
2. Release clutch
3. Let engine and gears slow down to the RPM required for the next gear (this takes practice)
4. Push in clutch and shift to the higher gear at the same time
5. Release clutch and press accelerator at the same time

Shifting gears using double clutching requires practice. If you remain too long in neutral, you may have difficulty putting the vehicle into the next gear. If so, do not try to force it. Return to neutral, release clutch, increase engine speed to match road speed and try again.

### **Knowing When to Shift Up**

There are two ways of knowing when to shift:

1. Use engine speed (RPM). Study the driver's manual for your vehicle and learn the operating RPM range. Watch your tachometer and shift up when your engine reaches the top of the range. (some newer vehicles use "progressive" shifting: the RPM at which you shift becomes higher as you move up in the gears. Find out what is right for the vehicle you will operate).
2. Use road speed (MPH). learn what speeds each gear is good for, then by using the speedometer you will know when to shift up.

With either method, you may learn to use engine sounds to know when to shift.

### **Basic Procedure for Shifting Down**

1. Release accelerator, push in clutch and shift to neutral at the same time
2. Release clutch
3. Press accelerator increase engine and gear speed to the RPM required in the lower gear.
4. Push in clutch and shift to lower gear at the same time
5. Release clutch and press accelerator at the same time

Downshifting, like upshifting, requires knowing when to shift. Use either the tachometer or the speedometer and downshift at the right RPM or road speed.

### **Special conditions where you should downshift are:**

1. Before starting down a hill  
Slow down, then shift down to a speed that you can control without using the brakes hard. Otherwise, the brakes can overheat and lose their braking power. Downshift before starting down the hill. Make sure you are in a low enough gear, usually lower than the gear required to climb the same hill, and NEVER attempt to shift while descending a grade.
2. Before entering a curve  
Slow down to a safe speed, and downshift to the right gear before entering the curve. This lets you use some power through the curve to help the vehicle be more stable while turning. It also lets you speed up as soon as you are out of the curve.

Multi-speed rear axles and auxiliary transmissions are used on many vehicles to provide extra gears. You usually control them by a selector knob or switch on the gearshift lever of the main transmission. There are many different shift patterns. Learn the right way to shift gears in the vehicle you will drive.



Some vehicles have automatic transmissions. You can select a low range to get greater engine braking when going down grades. The lower ranges prevent the transmission from shifting up beyond the selected gear (unless the governor RPM is exceeded). It is very important to use this braking effect when going down grades.

Some vehicles have “retarders”. Retarders help slow a vehicle, reducing the need for using your brakes. They reduce brake wear and give you another way to slow down. There are many types of retarders (exhaust, engine, hydraulic, electric). All retarders can be turned on or off by the driver. On some, the retarding power can be adjusted. When turned “on”, retarders apply their braking power (to the drive wheels only) whenever you let up on the accelerator pedal all the way.

**CAUTION:** When your drive wheels have poor traction, the retarder may cause them to skid. Therefore, you should turn the retarder off whenever the road is wet, icy or snow covered.

**Seeing:**

To be a safe driver you need to know what is going on all around your vehicle. Not looking properly is a major cause of accidents.

Seeing Ahead: All drivers look ahead, but many do not look far enough ahead. Because stopping or changing lanes can take a lot of distance, knowing what the traffic is doing on all sides of you is very important. You need to look well ahead to make sure you have room to make these moves safely.

How Far Ahead to Look: Most good drivers look 12 to 15 seconds ahead. That means looking ahead the distance you will travel in 12 to 15 seconds. At lower speeds, that is about one block. At highway speeds it is about a quarter of a mile. If you are not looking that far ahead, you may have to stop too quickly or make quick lane changes. Looking 12 to 15 seconds ahead does not mean to not pay attention to things that are closer. Good drivers shift their attention back and forth, near and far.

Look for Traffic: Look for vehicles coming onto the highway or into your lane or turning. Watch for brake lights from slowing vehicles. By seeing these things far enough ahead, you can change your speed or change lanes if necessary, to avoid a problem.

Look for Road Conditions: Look for hills and curves—anything you will have to slowdown or change lanes for. Pay attention to traffic signals and signs. If a light has been green for a long time, it will probably change before you get there. Start slowing down and be ready to stop. Traffic signs may alert you to road conditions where you may have to change speed.

## Operating in the Mine Environment

Most trucks being operated in the mining environment that are equipped with air brakes have a very large drawback. These trucks were primarily designed to operate on the highway. Factors considered when designing a truck for on-highway use do not always reflect the conditions under which the truck will operate in the mine environment. To say that mining is a severe service environment compared with interstate highway operation is a gross understatement. Some factors that are normal for mining but not for highway operations include:

- Gross vehicle weights at or above the manufacturer's rating
- Roads with grades greater than seven percent
- Irregular unpaved surfaces
- Large amounts of abrasive dust (watered roads can be worse)
- Short cycle times between loaded and empty

It is very easy to take a truck beyond its intended design limit when operating in the mining environment. In addition to good driving skills, you must have the skills needed to easily recognize equipment problems that endanger you and your co-workers.

## COMMUNICATIONS

Other drivers cannot know what you are going to do until you tell them.

Traffic Patterns: On several mine sites, left-hand, one-way or switching traffic patterns are frequently used on haulage roads as well as the conventional right-hand traffic flow pattern used on public roads. This use on public roads that are applicable. A set of signs to warn and give notice of changes in the traffic pattern is designed for this specific purpose. Pay constant attention to the signs indicating travel directions and be aware of possible changes.



Signal Your Intentions: Signaling what you intend to do is important for safety. Here are some general rules for signaling.

### Turns

Here are three good rules for using turn signals:

1. Signal early. Signal well before you turn. It is the best way to keep others from trying to pass you.
2. Signal continuously. You need both hands on the wheel to turn safely. Do not cancel the signal until you have completed the turn.
3. Cancel your signal. Do not forget to turn off your turn signal after you have completed your turn (if you do not have self-canceling signals).

**Lane Changes:** Put your turn signal on before changing lanes. Change lanes slowly and smoothly. That way a driver you did not see may have a chance to honk his or her horn or avoid your vehicle.

**Slowing Down:** Warn drivers behind you when you see you will need to slow down. A few light taps on the brake pedal—enough to flash the brake lights—should warn following drivers. Use the 4-way emergency flashers for times when you are driving very slowly or are stopped. Warn other drivers in any of the following situations.

1. Trouble Ahead

The size of your vehicle may make it hard for drivers behind you to see hazards ahead. If you see a hazard that will require slowing down, warn the drivers behind you by flashing your brake lights.

2. Tight Turns

Most car drivers do not know how slow you have to go to make a tight turn in a large vehicle. Give drivers behind you a warning by braking early and slowing gradually.

3. Driving Slowly

Drivers often do not realize how fast they are catching up to a slow vehicle until they are very close. If you must drive slowly, alert following drivers by turning on your emergency flashers if it is legal. (Laws regarding the use of flashers differ from one state to another. Check the laws of the states where you will drive.)

4. Do Not Direct Traffic

Some drivers try to help others by signaling when it is safe to pass. You should not do this. You could cause an accident.

### **Communicating Your Presence**

Other drivers may not notice your vehicle even when it is in plain sight. Let them know you are there to help prevent accidents.

#### **When Passing**

Whenever you are about to pass a vehicle, pedestrian, or bicyclists, assume they do not see you. They could suddenly move in front of you. When it is legal, tap the horn lightly or, at night, flash your lights from low to high beam and back. Also, drive carefully enough to avoid a crash even if they do not see or hear you.

#### **When It Is Hard to See**

At dawn or dusk or in rain or snow, you need to make yourself easier to see. If you are having trouble seeing other vehicles, other drivers will have trouble seeing you. Turn on your lights. Use the headlights, not just the identification or clearance lights. Use the low beams; high beams can bother people in the daytime as well as at night.

**When Parked at the Side of the Road**

When you pull off the road and stop, be sure to turn on the 4-way emergency flashers. This is important at night. Do not trust the taillights to give warning. Drivers have crashed into the rear of a parked vehicle because they thought it was moving normally.

If you must stop on a road or the shoulder of a road, you should put out your reflective triangles within ten minutes. When putting out the triangles hold them between yourself and the oncoming traffic for your own safety. (So other drivers can see you)

**Use Your Horn When Needed**

Your horn can let others know you are there. It can help to avoid a crash. Use your horn when needed. However, it can startle others and could be dangerous when used unnecessarily.

**Controlling Speed**

Driving too fast is a major cause of fatal crashes. You must adjust your speed depending on driving conditions. These include traction, curves, visibility, traffic and hills.

**Speed and Stopping Distance**

There are three things that add up to total stopping distance:

$$\begin{array}{r}
 \text{Perception Distance} \\
 + \text{Reaction Distance} \\
 + \text{Braking Distance} \\
 \hline
 = \text{Total Stopping Distance}
 \end{array}$$

**Perception Distance**

This is the distance your vehicle travels from the time your eyes see a hazard until your brain recognizes it. The perception time for an alert driver is about  $\frac{3}{4}$  of a second. At 55 mph, you travel 60 feet in  $\frac{3}{4}$  of a second.

**Reaction Distance**

The distance traveled from the time your brain tells your foot to move from the accelerator until your foot is pushing the brake pedal. The average driver has a reaction time of  $\frac{3}{4}$  of a second. This accounts for an additional 60 feet traveled at 55 mph.

**Total Stopping Distance**

At 55 mph it will take about six (6) seconds to stop and your vehicle will travel about the distance of a football field. (60 + 60 + 170 = 290 feet).

**The Effect of Speed on Stopping Distance**

Whenever you double your speed, it takes about four times as much distance to stop and your vehicle will have four times the destructive power if it crashes. High speeds increase stopping distances greatly. By slowing down a little, you can gain a lot in reduced braking distance.

### The Effect of Vehicle Weight on Stopping Distance

The heavier the vehicle, the more work the brakes must do to stop it and the more heat they absorb. But the brakes, tires, springs and shock absorbers on heavy vehicles are designed to work best when the vehicle is fully loaded. Empty trucks require greater stopping distances because an empty vehicle has less traction. It can bounce and lock up its wheels, giving much poorer braking. (This is not usually the case with buses)

### Matching Speed to the Road Surface

You cannot steer or brake a vehicle unless you have traction. Traction is friction between the tires and the road. There are some road conditions that reduce traction and call for lower speeds.

### Slippery Surfaces

It will take longer to stop, and it will be harder to turn without skidding when the road is slippery. You must drive slower to be able to stop in the same distance as on a dry road. Wet roads can double the stopping distance. Reduce speed by about one third (e.g., slow from 55 to 35 mph) on wet road. On packed snow, reduce speed by a half, or more. If the surface is icy, reduce speed to a crawl and stop driving as soon as you can safely do so.

### Identifying Slippery Surfaces

Sometimes it is hard to know if the road is slippery. Here are some signs of slippery roads.

1. Shaded Areas

Shady parts of the road will remain icy and slippery long after open areas have melted.

2. Bridges

When the temperature drops, bridges will freeze before the road will. Be especially careful when the temperature is close to 32° Fahrenheit.

3. Melting Ice

Slight melting will make ice wet. Wet ice is much more slippery than ice that is not wet.

4. Black Ice

Black ice is a thin layer that is clear enough that you can see the road underneath it. It makes the road look wet. Any time the temperature is below freezing, and the road looks wet, watch out for black ice.

5. Vehicle Icing

An easy way to check for ice is to open the window and feel the front of the mirror, mirror support, or antenna. If there is ice on these, the road surface is probably starting to ice up.

6. Just After Rain Begins

Right after it starts to rain, the water mixes with oil left on the road by vehicles. This makes the road very slippery. If the rain continues, it will wash the oil away.

#### 7. Hydroplaning

In some weather, water or slush collects on the road. When this happens, your vehicle can hydroplane. It is like water skiing; the tires lose their contact with the road and have little or no traction. You may not be able to steer or brake. You can regain control by releasing the accelerator and pushing in the clutch. This will slow your vehicle and let the wheels turn freely. If the vehicle is hydroplaning, do not use the brakes to slow down. If the drive wheels start to skid, push in the clutch to let them turn freely.

It does not take a lot of water to cause hydroplaning. Hydroplaning can occur at speeds as low as 30 mph if there is a lot of water. Hydroplaning is more likely if tire pressure is low or the tread is worn. (The grooves in a tire carry away the water: if they are not deep, they do not work well.) Be especially careful driving through puddles. The water is often deep enough to cause hydroplaning.

### **Speed and Curves**

Drivers must adjust their speed for curves in the road. If you take a curve too fast, two things can happen. The wheels can lose their traction and continue straight ahead (so you skid off the road), or the wheels may keep their traction and the vehicle rolls over. Tests have shown that trucks with a high center of gravity can roll over at the posted speed limit for a curve.

Slow to a safe speed before you enter a curve. Braking in a curve is dangerous because it is easier to lock the wheels and cause a skid. Slow down as needed. Do not ever exceed the posted speed limit for the curve. Be in a gear that will let you accelerate slightly in the curve. This will help you keep control.

### **Speed on Downgrades**

Going slow is the most important thing in going down long steep hills safely. If you do not go slowly enough, your brakes can become so hot they will not slow you down. Shift your transmission to a low gear before starting down the grade. Pay attention to signs warning of long downhill grades and check your brakes before starting down the hill. Use a light, steady pressure on the brake pedal.

### **Managing Space**

To be a safe driver, you need space all around your vehicle. When things go wrong, space gives you time to think and to take action. To have space available when something goes wrong, you need to manage space. While this is true for all drivers, it is very important for large vehicles. They take up more space and they require more space for stopping and turning.

### **Space Ahead**

Of all the space around your vehicle, it is the area ahead of the vehicle—the space you are driving into—that is most important.

### The Need for Space Ahead

You need space ahead in case you must stop suddenly. According to accident reports, the vehicle that trucks most often run into is the one in front of them. The most frequent cause is following too closely, remember, if the vehicle ahead of you is smaller than yours, it can probably stop faster than you can. You may crash if you are following too closely.

### Space Behind

You cannot stop others from following you too close. But there are things you can do to make it safer.

1. Stay to the right

Heavy vehicles are often tailgated when they cannot keep up with the speed of traffic. This often happens when you are going uphill. If a heavy load is slowing you down, stay in the right lane if you can. Going uphill, you should not pass another slow vehicle unless you can get around quickly and safely.

2. Deal with tailgaters safely

In a large vehicle, it is often hard to see whether a vehicle is close behind you. You may be tailgated:

- a. When you are traveling slowly. Drivers trapped behind slow vehicles often follow closely.
- b. In bad weather, many car drivers follow large vehicles closely during bad weather especially when it is hard to see the road ahead.

If you find yourself being tailgated, there are some things you can do to reduce the chances of a crash:

- a. Avoid quick changes. If you must slow down or turn, signal early and reduce speed very gradually.
- b. Increase your following distance. Opening room in front of you will help you avoid having to make sudden speed or direction changes. It also makes it easier for the tailgater to get around you.
- c. Do not speed up. It is safer to be tailgated at a low speed than a high speed.
- d. Avoid tricks. Do not turn on your taillights or flash you brake lights. Follow the suggestions above.
- e. To avoid contributing to an accident, do not direct traffic around your vehicle.

### Space to the Sides

Commercial vehicles are often wide and take up most of a lane. Safe drivers will manage what little space they have. You can do this by keeping your vehicle centered in your lane and avoid driving alongside others.

### Staying Centered in a Lane

You need to keep your vehicle centered in the lane to keep safe clearance on either side. If your vehicle is wide, you have little room to spare.

### Traveling Next to Others

There are two dangers in traveling alongside other vehicles:

- a. Another driver may change lanes suddenly and turn into you.
- b. You may be trapped when you need to change lanes.

### Space Overhead

Hitting overhead objects is a danger. Make sure you always have overhead clearance. Do not assume that the heights posted at bridges and overpasses are correct. Repaving or packed snow may have reduced the clearances since the heights were posted. The weight of a cargo van changes its height. An empty van is higher than a loaded one. If you go under a bridge when you were loaded does not mean that you can do it when you are empty.

If you doubt you have safe space to pass under an object, go slowly. If you are not sure you can make it, take another route. Warnings are often posted on low bridges or underpasses, but sometimes they are not.

Some roads can cause a vehicle to tilt. There can be a problem clearing objects along the edge of the road, such as signs or trees. Where this is a problem, drive a little closer to the center of the road.

Before you back into an area, get out and check for overhanging objects, such as trees, branches, or electric wires. It is easy to miss seeing them while you are backing. (Also check for other hazards at the same time)

### Space Below

Many drivers forget about the space under their vehicles. That space can be very small when a vehicle is heavily loaded. Railroad tracks can stick up several inches. This is often a problem on dirt roads and in unpaved yards where the surface around the tracks can wear away. Do not take a chance on getting hung up halfway across. Drainage channels across roads can cause the end of some vehicles to drag. Cross such depressions carefully.

### Space for Turns

The space around a truck is important in turns. Because of wide turning and off-tracking, large vehicles can hit other vehicles or objects during turns.

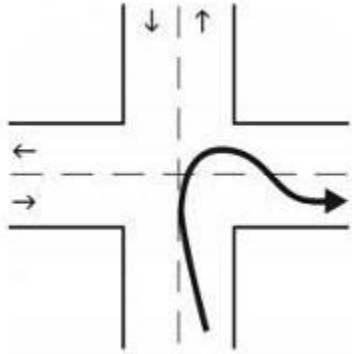
### Right Turns

Here are some rules to help prevent right-turn crashes:

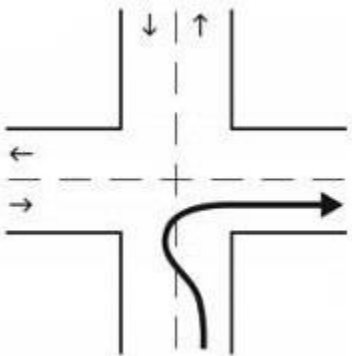
1. Turn slowly to give yourself and others more time to avoid problems.



2. If you are driving a truck that cannot make the right turn without swinging into another lane, turn wide as you complete the turn. Keep the rear of your vehicle close to the curb. This will stop other drivers from passing you on the right. (As shown in the figure below)



3. Do not turn wide to the left as you start the turn (As shown in the figure below). A following driver may think you are turning left and try to pass you on the right. You may crash into the other vehicle as you complete your turn.



4. If you must cross into the oncoming lane to make a turn, watch out for vehicles coming toward you. Give them room to go by or to stop. However, do not back up for them because you might hit someone behind you.

### Left Turns

On a left turn, make sure you have reached the center of the intersection before you start the left turn. If you turn too soon, the left side of your vehicle may hit another vehicle because of off tracking.

### **Space needed to Cross or Enter Traffic**

Be aware of the size and weight of your vehicle when you cross or enter traffic. Here are some important things to keep in mind:

1. Because of slow acceleration and the space large vehicles require, you may need a much larger gap to enter traffic than you would in a car.
2. Acceleration varies with the load. Allow more room if your vehicle is heavily loaded.

3. Before you start across a road, make sure you can get all the way across before traffic reaches you.

### **Driving at Night**

You are at greater risk when you drive at night. Drivers cannot see hazards as soon as in daylight, so they have less time to respond. Drivers caught by surprise are less able to avoid a crash. The problems of night driving involve the driver, the roadway and the vehicle. We will discuss each of these factors.

#### **Vison**

People cannot see as sharply at night or in dim light. Also, the eyes need time to adjust to seeing in dim light. Most people have noticed this when walking into a dark movie theater.

#### **Glare**

Drivers can be blinded for a short time by bright light. It takes time to recover from this blindness. Older drivers are especially bothered by glare. Most people have been temporarily blinded by camera flash units or by the high beams of an oncoming vehicle. It can take several seconds to recover from glare. Even two seconds of glare blindness can be dangerous. A vehicle going 55 mph will travel more than half the distance of a football field during that time. Do not look directly at bright lights when driving. Look at the right side of the road. Watch the sidelines when someone is coming toward you with very bright lights.

#### **Fatigue and Lack of Alertness**

Fatigue (being tired) and lack of alertness are bigger problems at night. The body's need for sleep is beyond a person's control. Most people are less alert at night, especially after midnight. This is particularly true if you have been driving for a long time. Drivers may not see hazards as soon or react as quickly, so the chance of a crash is greater. If you are sleepy, the only safe cure is to get off the road and get some sleep. If you do not, you risk your life and the lives of others.

#### **Poor Lighting**

In the daytime there is usually enough light to see well. This is not true at night. Some areas may have bright streetlights, but many areas will have poor lighting. On most roads you will probably have to depend entirely on your headlights. Less light means you will not be able to see hazards as well as in daytime. Road users who do not have lights are hard to see. There are many accidents at night involving pedestrians, joggers, bicyclists and animals.

Even when there are lights, the road scene can be confusing. Traffic signals and hazards can be hard to see against a background of signs, shop windows and other lights. Drive slower when lighting is poor or confusing. Drive slowly enough to be sure you can stop in the distance you can see ahead.

#### **Drunk Drivers**

Drunk drivers and drivers under the influence of drugs are a hazard to themselves and to you. Be especially alert around the closing times for bars and taverns. Watch for drivers who have trouble

staying in their lane or maintaining speed, stop without reason or show other signs of being under the influence of alcohol or drugs.

### Headlights

At night your headlights will usually be the main source of light for you to see and for others to see you. You cannot see nearly as much with your headlights as you can see in the daytime. With low beams you can see ahead about 250 feet and with high beams about 350-500 feet. You must adjust your speed to keep your stopping distance within your sight distance. This means going slow enough to be able to stop within the range of your headlights. Otherwise, by the time you see a hazard, you will not have time to stop.

Night driving can be more dangerous if you have problems with your headlights. Dirty headlights may give only half the light they should. This cuts down your ability to see and makes it harder for others to see you. Make sure your lights are clean and working. Headlights can be out of adjustment. If they do not point in the right direction, they do not give you a good view and they can blind other drivers. Have a qualified person make sure they are adjusted properly.

### Other Lights

For you to be seen easily, the following must be clean and working properly:

1. Reflectors
2. Marker lights
3. Clearance lights
4. Identification lights

### Turn Signals and Brake Lights

At night your turn signals and brake lights are even more important for telling other drivers what you intend to do. Make sure you have clean, working turn signals and stop lights.

### Windshields and Mirrors

It is more important at night than in the daytime to have clean windshields and mirrors. Bright lights at night can cause dirt on your windshield or mirrors to create a glare of its own, blocking your view. Most people have experienced driving toward the sun just as it has risen or is about to set and found that they can barely see through a windshield that seemed to look okay in the middle of the day. Clean your windshield on the inside and outside for safe driving at night.

## **Night Driving Procedures**

### Pre-Trip Procedures

Make sure you are rested and alert. If you are drowsy, sleep before you drive! Even a nap can save your life or the lives of others. If you wear eyeglasses, make sure they are clean and unscratched. Do not wear sunglasses at night. Do a complete pre-trip inspection of your truck. Pay attention to checking all lights and reflectors and cleaning those you can reach.

### Avoid Blinding Others

Glare from your headlights can cause problems for drivers coming towards you. They can also bother drivers going in the same direction you are, when your lights shine in their rearview mirrors. Dim your lights before they cause glare for other drivers. Dim your lights within 500 feet of an oncoming vehicle and when following another vehicle within 500 feet.

### Avoid Glare from Oncoming Vehicles

Do not look directly at lights of oncoming vehicles. Look slightly to the right at a right lane or edge marking if available. If other drivers do not put their low beams on, do not try to “get back at them” by putting your own high beams on. This increases glare for oncoming drivers and increases the chance of a crash.

### Use High Beams When You Can

Some drivers make the mistake of always using low beams. This seriously cuts down on their ability to see ahead. Use high beams when it is safe and legal to do so. Use them when you are not within 500 feet of an approaching vehicle. Also, do not let the inside of your cab get too bright. This makes it harder to see outside. Keep the interior light off and adjust your instrument lights as low as you can and still read the gauges.

### If You Get Sleepy, Stop Driving at the Nearest Safe Place

People often do not realize how close they are to falling asleep even when their eyelids are falling shut. If you can safely do so, look at yourself in a mirror. If you look sleepy, or you just feel sleepy, **STOP DRIVING!** You are in a very dangerous condition. The only safe cure is to sleep.

### Mountain Driving

In mountain driving, the force of gravity plays a major role. If you have a heavy load, you will have to use lower gears and go slower to climb hills. In coming down steep hills, gravity will tend to speed you up. You must go slow enough that your brakes can hold you back without getting too hot. If the brakes become too hot, they may start to “fade”. This means that you must apply them harder and harder to get the same stopping power. If the brakes continue to be used hard, they can continue to fade until you cannot slow down or stop at all. These dangers can be avoided by going slow when going down hills.

No matter what the size of your vehicle, going down long, steep grades can cause your brakes to fail if you go too fast. Using lower gears will help you keep from going too fast. Lower gears allow engine compression and friction to help slow the vehicle. This is true whether you have an automatic transmission or a manual transmission.

If you do have a large vehicle with a manual transmission, do not wait until you have started down the hill to shift down. You might get hung up in neutral and would lose the benefit of engine braking. You would find yourself coasting, which would be illegal and dangerous. **BE IN THE RIGHT GEAR BEFORE STARTING DOWN THE HILL.**

With older trucks, a rule for choosing gears was to use the same gear going down a hill that you would need to climb the hill. However, new trucks have low friction parts and streamlined shapes for fuel economy. They may also have more powerful engines. This means they can go up hills in higher gears and have less friction and air drag to hold them back going down hills. For that reason, drivers of modern trucks may have to use **lower gears going down a hill** than would be required to go up the hill. Find out what is right for your vehicle.

When going downhill, brakes will always heat up. They are designed so brake shoes or pads rub against the brake drum or disks to slow the vehicle, which creates heat. Brakes are designed to take a lot of heat. However, brakes can be made to fail from excessive heat by attempting to slow down from too high a speed too many times or too quickly. Brakes will fade (have less stopping power) when they get very hot, and they can get to the point where they will no longer slow the vehicle.

The right way to use your brakes for long downhill grades is to go slow enough that a light use of the brakes will keep your speed from increasing. If you go slow enough, brakes will be able to get rid of the heat and they will not get too hot.

Some people believe that letting up on the brakes from time to time will allow them to cool enough so they do not become overheated. Tests have proven this is not true. Brake drums cool very slowly, so the amount of cooling between applications is not enough to prevent overheating. This type of braking requires heavier brake pressures than steady application does. Heavy pressure on the brakes from time to time builds up more heat than light continuous pressure does. Therefore, select the right gear, go slow enough, and maintain a lighter, steadier use of the brakes.

### Loss of Control

According to available statistics, most serious accidents and fatalities occur when the driver or passengers jump from a runaway truck. To avoid being seriously injured, it is therefore recommended that you remain in the vehicle, with your seat belt on and in use. Your chances of less serious accidents are better if you remain in the vehicle. Remember, keeping your vehicle under control will prevent such occurrences.

### **Escape Ramps**

Escape ramps have been built on many steep mountain grades. Escape ramps are made to stop runaway vehicles safely without injuring drivers and passengers. Escape ramps use a long bed of loose soft material (pea gravel) to slow a runaway vehicle, sometimes in combination with an upgrade.

Know escape ramp locations on your route. Signs show drivers where ramps are located. Escape ramps save lives, equipment and cargo. Use them if you lose your brakes. Remember; good maintenance, frequent vehicle inspections and maintaining proper control are better alternatives.

**Accident Procedures**

When you are in an accident and not seriously hurt, you need to act to prevent further damage or injury. The basic steps to be taken at any accident are to:

1. Protech the area
2. Notify authorities
3. Care for injured

The first thing to do at an accident scene is to keep another accident from happening at the same spot. To protect the accident area:

1. If your vehicle is involved in the accident, try to get it to the side of the road. This will help prevent another accident and allow traffic to move.
2. If you are stopping to help, park away from the accident. The area immediately around the accident will be needed for emergency vehicles.
3. Put on your flashers
4. Set out reflective triangles to warn other traffic. Make sure they can be seen by other drivers in time for them to avoid the accident.

If you have a CB, put out a call over the emergency channel before you get out of your vehicle. If not, wait until after the accident scene has been properly protected, then phone or send someone to phone the police. Try to determine where you are so you can give the exact location.

If a qualified person is at the accident and helping the injured, stay out of the way unless asked to assist. Otherwise, do the best you can to help any injured parties. Here are some simple steps to follow in giving assistance:

1. Do not move a severely injured person unless the danger of fire or passing traffic makes it necessary.
2. Stop heavy bleeding by applying direct pressure to the wound.
3. Keep the injured person warm

**Driving Fitness**

Driving a vehicle for long hours is tiring. Even the best of drivers will become less alert. However, there are things that good drivers do to help stay alert and safe. Here are a few suggestions:

1. Get enough sleep  
Leaving on a long trip when you are already tired is dangerous. If you have a long trip scheduled, make sure that you get a enough sleep prior to departure. Most people require 7-8 hours of sleep every 24 hours.
2. Schedule trips safely

Your body gets used to sleeping during certain hours. If you are driving during those hours, you will be less alert. If possible, try to schedule trips for the hours you are normally awake. Many heavy motor vehicle accidents occur between midnight and 6 am. Tired drivers can easily fall asleep at these times, especially if they do not regularly drive at those hours. Trying to push on and finish a long trip at these times can be very dangerous.

3. Avoid medication

Many medicines can make you sleepy. Those that do have a label warning against operating vehicles or machinery. The most common medicine of this type is ordinary cold pills. If you must drive with a cold, you are better off suffering from the cold than from the effects of the medicine.

4. Keep cool

A hot, poorly ventilated cab can make you sleepy. Keep the window or vent cracked or use the air conditioner, if you have one.

5. Take breaks

Short breaks can keep you alert. But the time to take them is before you feel drowsy or tired. Stop often. Walk around and inspect your vehicle. It may help to do some physical exercises.

### **When You Do Become Sleepy**

When you are sleepy, trying to “push on” is far more dangerous than most drivers think. It is a major cause of fatal accidents. Here are some important rules to know:

1. Stop to sleep.

When your body needs sleep, sleep is the only thing that will work. If you have to make a stop anyway, make it whenever you feel the first sign of sleepiness, even if it is earlier than you planned. By getting up a little earlier the next day, you can keep on schedule without the danger of driving while you are not alert.

2. Take a nap.

If you cannot stop for the night, at least pull off the road and take a nap. A nap as short as a half-hour will do more to overcome fatigue than a half-hour coffee stop.

3. Avoid drugs.

There are no drugs that can overcome being tired. While they may keep you awake for a while, they will not make you alert. Eventually, you will be even more tired than if you had not taken them at all. Sleep is the only thing that can overcome fatigue.

### **Alcohol and Driving**

Drinking alcohol and then driving is a very serious problem. People who drink alcohol are involved in traffic accidents resulting in more than 20,000 deaths every year. You should know:

1. How alcohol works in the human body
2. How it affects driving
3. Laws regarding drinking and driving
4. Legal, financial, and safety risks of drinking and driving

### What is a Drink?

It is the alcohol in drinks that affects human performance. It does not make any difference whether that alcohol comes from “a couple beers” or from two glasses of wine or two shots of hard liquor. All the following drinks contain the **same amount** of alcohol:

- A 12-ounce glass of 5% beer
- A 15-ounce glass of 12% wine
- A 1 ½ ounce shot of 80 proof liquor

### How alcohol works

Alcohol goes directly from the stomach into the blood stream. A drinker can control the amount of alcohol which he or she takes in, by having fewer drinks or none. However, the drinker cannot control how fast the body gets rid of the alcohol. If you have drinks faster than the body can get rid of them, then you will have more alcohol in your body and your driving will be more affected. The amount of alcohol in your body is commonly measured by the Blood Alcohol Concentration (BAC).

### What Determines Blood Alcohol Concentration

BAC is determined by the amount of alcohol you drink (more alcohol means higher BAC), how fast you drink (faster drinking means higher BAC), and your weight (a small person does not have to drink as much to reach the same BAC).

### Alcohol and the Brain

Alcohol affects more and more of the brain as BAC builds up. The first part of the brain affected controls judgement and self-control. One of the bad things about this is it can keep drinkers from knowing they are getting drunk. And of course, good judgement and self-control are necessary for safe driving. As blood alcohol concentration continues to build up, muscle control, vision and coordination is affected more and more. Eventually, a person will pass out.

### How Alcohol Affects Driving

All drivers are affected by drinking alcohol. Alcohol affects judgement, vision, coordination and reaction time. It causes serious driving errors, such as:

1. Increased reaction time to hazards
2. Driving too fast or too slowly
3. Running over the curb
4. Weaving
5. Straddling lanes
6. Quick, jerky starts
7. Not signaling, failure to use lights
8. Running stop signs and red lights



## 9. Improper passing

These affects mean increased chanced of a crash and chances of losing your driver's license. Accident statistics show that the chance of a crash is much greater for drivers who have been drinking than for drivers who were not.

### Other Drugs

Besides alcohol, other legal and illegal drugs are being used more often. Laws prohibit possession or use of many drugs while on duty. They prohibit being under the influence of a "controlled substance", and amphetamine (including "pep pills" and "bennies"); narcotics or any other substance that can make the driver unsafe. This could include a variety of prescription and over-the-counter drugs (cold medicines) which may make the driver drowsy or otherwise affect safe driving ability. However, possession and use of a drug given to a driver by a doctor is permitted if the doctor informs the driver that it will not affect safe driving ability.

Pay attention to warning labels of legitimate drugs and medicines and to doctors' orders regarding possible effects. Stay away from illegal drugs. Do not use any drug that hides fatigue – the only cure for fatigue is rest. Alcohol can make the effects of other drugs much worse. The safest rule is, do not mix drugs with driving at all. West Virginia Office of Miners' Health, Safety and Training has specific laws concerning drug and alcohol use. It is the law (as DOT) that truck drivers be tested. The alcohol concentration per state mining law is at .04 percent (less than State Police). Also, a reminder is that refusal of drug and alcohol testing is now considered a positive result. Our law is "two strikes" you're out, a second failure will constitute permanent revocation of all mining certifications issued by West Virginia Office of Miners' Health, Safety and Training.

### Illness

Occasionally, you may become so ill that you cannot operate a motor vehicle safely. If this happens to you, you must not drive. However, in case of emergency, you may drive to the nearest place where you can safely stop.

## **GENERAL TRUCKING HAZARDS**

## **TRAINING MANUAL**

## **WEST VIRGINIA OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING**

**Overview****Prerequisites:** None**PURPOSE:**

The purpose of this lesson is to stress to the student the importance of identifying and managing general hazards associated with the operation of a coal truck.

**MATERIALS:****Instructional Aids**

Powerpoint Presentation (Dumping Video, Railroad Video, Truck Hazard Recognition Video)

**Student Materials and Instructor Material**

Training Manual

**Content**

1. Loading and Dumping
2. Safety around Power Lines
3. Lack of Communication
4. Railroad Crossings
5. Highwalls and Stockpiles

## INSTRUCTOR OVERVIEW – GENERAL TRUCKING HAZARDS

### **PURPOSE**

The purpose of this lesson is to show the importance of body positioning during loading and unloading, show the importance of overhead inspection of dumping areas, importance of good two-way communications, importance of proper railroad crossing safety and proper highwall and stockpile inspection.

### **KNOWLEDGE OBJECTIVES**

Student must know:

- Driver location during the loading process and identify accident causes during dumping process.
- The effect of powerlines on a truck/trailer and prevention of electrical accidents.
- Identifying what accidents may occur as a result of a lack of communication.
- Identifying what accidents may occur as a result of improper railroad crossing.
- Proper inspection and driver responsibility around highwalls and stockpiles.

### **PERFORMANCE OBJECTIVES**

Students must be able to:

- Know where to be and why during loading and dumping of truck.
- Inspect loading and dump sites for possible hazards, including overhead.
- Recognize proper and improper two-way communications.
- Recognize railroad crossing hazards.

## LOADING AND DUMPING

Part of your time spent while operating a coal truck will be getting loaded and dumping your load of coal. There are safety precautions that need to be followed during these processes.

### Staging area waiting to be loaded

1. Stay in the cab.
2. Clearly communicate your intentions if you need to get out of the cab.
3. In between two trucks may not be the safest place to congregate.
4. If you need to enter your trailer/bed of truck, then make sure other operators are aware of where you are.

### During Loading

1. Stay in the cab
2. Clearly communicate your intentions if you need to get out of the cab.
3. If you exit the cab you should make eye contact with other operators (loader).

### Dumping

1. Inspect dumping area before entering.
2. While backing in make sure the truck/trailer is level.
3. Make sure tailgate has opened prior to raising truck bed/trailer.
4. Be conscious of the possibility of coal sticking.

## POWERLINES

Most loading and dumping areas are constructed so that there are no powerlines in the area. Not all drivers tarp their loads in the same area. This area may be more likely to contain overhead hazards (powerlines) if not an assigned tarping area. Regardless, anytime you are tarping or dumping the area above you **MUST** be inspected.

Powerlines and truck beds/trailers or tarp poles DO NOT MIX! If your truck bed/trailer or tarp poles should contact a powerline and you are not being shocked or if your truck isn't on fire, **SIT STILL!** Do not move or touch anything until it is certain that power has been removed. If your truck catches fire and you must exit the cab, it is important to jump free of the truck. **DO NOT** touch the truck and ground at the same time, you may be shocked. After clearing the truck, you need to shuffle your feet to get away from the truck to keep from bridging two different potentials of electricity.



## LACK OF COMMUNICATION

The lack of communication while operating a coal truck comes in many forms and is a large contributor to accidents.

1. NOT heeding road signs.
2. NOT paying attention to lights, that are for communication.
3. Too much or not enough radio communication.
4. Tuning out audible horns/alarms

## NO TEXTING WHILE DRIVING!

## RAILROAD CROSSING SAFETY

Railroad crossings are encountered many times while operating a coal truck. They are found around preparation plants and load outs as well as river docks.

1. Always stop at railroad crossings.
2. As on the road, use the right, left, right method to look before crossing.
3. **DO NOT** attempt to “beat” a train to the crossing.
4. Before crossing make sure that there is enough room for your truck to completely clear the tracks.
5. Train speeds are very easy to underestimate.



## HIGHWALLS AND STOCKPILES

Highwalls and stockpiles have the same hazards in regards to coal trucks. Constant attention must be practiced for drivers when they are exposed to either. Usually when you are getting loaded and when unloading (dumping) are the times of most exposure.

### Inspections

1. Prior to getting in the “danger zone” you, as a driver, must inspect the area.
  - a. Loose material in highwall
  - b. Cracks in Highwall
  - c. Trees close to the top edge
  - d. Freeze/thaw cycle
  - e. Presence of Highwall Miner/Auger Holes
  - f. Stockpile wall left standing
  - g. Equipment operating on top of Stockpile
  - h. Pedestrians (Coal Samplers) around Stockpile



**FIRST AID**

**TRAINING MANUAL**

**WEST VIRGINIA OFFICE OF MINERS' HEALTH, SAFETY AND TRAINING**



**Overview****Prerequisites:** None**PURPOSE:**

The purpose of this lesson is to introduce the student to basic first aid procedures.

**MATERIALS:****Instructional Aids**

Powerpoint presentation

**Student Materials and Instructor Material**

Training Manual

**Content**

1. Patient Assessment
2. Artificial Ventilation
3. CPR & AED
4. Control of Bleeding
5. Shock
6. Wounds and Dressings
7. Burns and Scalds
8. Musculoskeletal Injuries
9. Handling and Transportation

**FIRST AID** is emergency care given to someone who is injured or ill to prevent further injury or death. Remember this definition and it can help you to remember what to do in different situations. Some examples would be; If a patient is bleeding then to prevent further injury or death, we must stop the bleeding. Another example is if a patient is not breathing then we must breath for them to prevent further injury or death. If an arm is broken then we need to splint it to prevent further injury.

## PATIENT ASSESSMENT

Prior to any patient assessment, you must confirm that the scene is safe for you to give assistance. Do not move the patient unless absolutely necessary. If you were to be injured also you could not assist the patient. It is also equally important to protect yourself from body substances also. In other words you need Body Substance Isolation from the patient such as gloves, mask, eye protection. Blood born and air born pathogens can be as hazardous to you as environmental hazards. Get help on the way! Try to determine what caused the problem with the patient. Is their problem a Medical problem, such as chest pain, diabetic shock, allergic reaction? Those are “Medical” and you could start your “Medical Assessment”. Or, was the problem from an injury? Such as a broken bone, a cut or maybe an amputation. These are “Trauma”. Now you could start your “Trauma Assessment”. Regardless of which assessment, if you are performing one of these, this patient will need help, so don’t forget to get assistance. Let’s go over both assessment procedures.

### Medical Assessment

With either assessment you can begin with just getting a general impression of the patient. Always check to see how responsive the patient is also, are they awake, alert, talking, unconscious? At this point you must check for life threats first (breathing, heartbeat, any severe bleeding), nothing else will matter if a life threat is not detected and corrected. An example of this would be if your patient was not breathing you must quickly breath for them or their heart will stop. As stated before, at this point nothing else would matter.

If we are doing a medical assessment, because of your initial assessment, you can now ask questions such as signs and symptoms, allergies, etc. Use the S.A.M.P.L.E. acronym to ask questions.

S – Signs and Symptoms

A – Allergies

M – Medications

P – Past pertinent history (Example would be heart problems, diabetes, etc.)

L – Last oral intake (last thing patient ate or drank)

## E – Events leading up to present illness

After initial assessment (life threats) and questioning, you can now give whatever aid is called for such as passing information to EMT or EMS that the patient has a history of heart problems and may be the reason for chest pain. That is an example for “medical assessment”

### **Trauma Assessment**

As with a medical assessment you would get a general impression of the patient. Then check for responsiveness. Always check for life threats first, remember, nothing else will matter if these aren't found and corrective action taken quickly. After your life threat checks (A, B, C's) you would at that point assess patient from head to toe looking for secondary injuries, not life threatening such as cuts, broken bones, etc. Questioning patient or bystanders after injuries are cared for will be last thing. All of this information then is handed over to the EMT or EMS.

## **AIRWAY, BREATHING AND CIRCULATION**

### **Airway**

The airway must not be blocked if the patient is to receive life giving oxygen! As we assess our patient, we must detect and correct problems with the airway, their breathing and circulation. The tongue is the most common cause of a blocked airway in an unconscious person. When we are checking to see if patient has an open airway we can apply the head-tilt chin-lift or jaw thrust. Remove any visible foreign objects from the mouth.

### **Breathing**

Look, listen and feel for air movement from mouth and nose. As we are checking we can, at the same time, check patient's pulse. The best place to check for a pulse is in the neck on the carotid artery. Without breathing or pulse all other issues are not as important. If patient is not breathing but has a heartbeat we should perform rescue breathing. Without oxygen, brain cells will begin to die within 6 minutes. Time is essential! We should give them rescue breaths once every 5 seconds, about 12 a minute. Don't forget to go back and reassess patient to make sure their heart has not stopped during your rescue breathing. Do not stop until the patient is breathing on their own or trained help arrives to help.

## Circulation

As mentioned above, you will be checking for circulation at the same time you are checking for breathing. Check the pulse in the neck (carotid artery). This should not take more than 10 seconds. If they are not breathing and also have no heartbeat (pulse) then chest compressions as well as rescue breaths should be given. You should be trained to perform CPR. Chest compression done improperly will not be effective for the patient. When giving CPR the patient should be lying down flat on their back. Chest compressions are administered in the center of the chest, between the nipples, and compressed to two inches. Current CPR standards call for 30 compressions and then 2 breaths. The compressions are given at a rate of 100 to 120 a minute. In other words, hard and fast. After 2 minutes the patient should be checked for breathing and a pulse again.

## AED

### *Automated External Defibrillator*

Defibrillators are designed to deliver an electrical shock that will stimulate the heart to begin beating normally. The shock does not start a heart that has stopped completely, but it will give the fibrillating heart a chance to spontaneously reestablish an effective rhythm on its own. All West Virginia coal mines must, by law, have AED's. In the beginning when you asked for help you should also have had someone get the AED. It is important to know where those are located at the mine you are working at. AED's are not hard to operate. When you open the AED and turn it on it will tell or show you by illustrations (like on the pads) exactly what to do and when to do it. Remember, if the heart is not damaged too bad such as in an electrical shock or drowning, then the AED can be very effective.

## CONTROL OF BLEEDING

Bleeding is a major life threat like no breathing or heartbeat! Detecting and correcting bleeding is vitally important in first aid. Blood is what carries the oxygen to all of our body to give us life. Lack of it or loss of it can be fatal to us. Our blood vessels are capillaries, veins and arteries. Capillaries are the very small blood vessels that will "ooze" blood. Veins carry our blood back through lungs and heart to pick up oxygen. Arteries are the vessels that carry the blood from the heart to all of our body to deliver the oxygen. Pressure in arteries is higher than other blood vessels. The blood in arteries is oxygen rich also, therefore, if you have bright red blood

spurting from a vessel then you can determine that an artery has been cut. Veins carry the oxygen depleted blood back to the heart and will be darker in color and a steady flow instead of spurting. Major venous bleeding can be life threatening as well as arterial bleeding. Direct pressure on these vessels will control most bleeding. In severe cases of bleeding where direct pressure and elevation is not controlling it then tourniquets to control the bleeding may be necessary. The tourniquet would be applied between the heart and the wound, close to the wound.

## SHOCK

***Shock is defined as failure of the circulatory system.***

Circulatory failure has many possible causes, but the three primary causes are pump failure, pipe failure and fluid loss and this in turn causes insufficient blood flow which deprives the body of sufficient blood to function properly. In order to treat or help prevent shock, first, treat the illness or injury such as stopping the bleeding. Keep patient calm and reassure them. Lay them down and if no head injury or other injury prevents it, then elevate the feet. Keep them warm and dry.

### **Airway, Breathing, Circulation, Bleeding and Shock**

All of these need to be assessed first, potentially all can be fatal. After these we can move on to secondary injuries. We will start with Wounds and Dressings.

## WOUNDS AND DRESSINGS

A wound is an injury that is caused by any physical means that leads to damage of a body part. Wounds are classified as an ***open wound*** or a ***closed wound***.

**Closed wounds are when the skin is not broken.** Examples of closed wounds are bruises, sprains and strains. Bruises occur when capillaries are busted under the skin. Strains and sprains are damage to muscles, tendons and ligaments. Closed wounds are treated with cold (ice).



**Open wounds occur when there is a break in the skin.** Examples of open wounds are lacerations, punctures, avulsions, amputations and abrasions.

Treatment for open wounds first is to control bleeding because it can be life threatening. Secondary treatment would be dressing and bandaging the open wounds. These dressings and bandages are used to help control bleeding, protect wound from things that can cause contamination. It also can help immobilize the injured area and prevent movement of impaled objects.

- Dressings
  - A dressing is an object placed directly on a wound to control bleeding and prevent further contamination.
  - Once a dressing is in place, apply firm, direct manual pressure on it to stop any bleeding.
  - The three most common sizes are 4" × 4" gauze squares, 5" × 9" heavier pads, and 10" × 30" trauma dressings.
- Bandaging
  - A bandage is used to hold the dressing in place.
  - Roller gauze and triangular bandages are commonly used in the field.

## **BURNS AND SCALDS**

The skin serves as a barrier that prevents foreign substances from entering the body.

It also prevents loss of body fluids.

When the skin is damaged, it can no longer perform these essential functions.

### **Superficial burns (first-degree burns)**

Reddened and painful skin

The injury is confined to the outermost layers of the skin.

The patient experiences minor to moderate pain.

### **Partial-thickness burns (second-degree burns)**

Do not damage the deepest layers of the skin

Blistering

Fluid loss and moderate to severe pain

Usually heal within 2 to 3 weeks

### **Full-thickness burns (third-degree burns)**

Damage all layers of the skin

Pain is absent because the nerve endings have been destroyed.

## BURN TREATMENT

### **Thermal burns**

Caused by heat

Place the burned area in clean, cold water.

Cover it with a dry, sterile dressing or a burn sheet.

Do not break blisters.

Patients with large burns must be treated for shock and transported to a hospital. Patients lose large quantities of body fluids and are susceptible to shock and infection.

### **Chemical burns**

Many strong substances can cause chemical burns.

The longer the chemical remains in contact with the skin, the more damage it does.

Remove as much of the chemical as possible.

Brush away any dry chemical.

Flush with water for at least 10 minutes.

Cover the area with a dry, sterile dressing.

Arrange for prompt transport.

## MUSCULOSKELETAL INJURIES

Musculoskeletal injuries are injuries that involve the bones, muscles, tendons, ligaments and joints of the body. Injuries of this type can be very painful and can sever nerves, cut blood vessels and damage internal organs. Therefore, treatment must be aimed at stopping the bleeding if present and keeping the injured area from moving.

### **Signs and Symptoms**

- Pain at the injury site
- An open wound
- Swelling and Discoloration
- The patient's inability or unwillingness to move the extremity



- Deformity or angulation (abnormal bend or curve)
- Tenderness at the injury site

### **Examination of the injured limb**

- + Inspect the injured limb and compare it to the opposite uninjured limb.
- + Remove clothing if needed to examine injured limb.
- + When you examine the limb, you may find any one of the following:
  - Open wound
  - Deformity
  - Swelling
  - Bruising
- + Tenderness is the best indicator of an underlying fracture, dislocation, or sprain.
- + Start at the top of each limb and using both hands, squeeze the entire limb in a systematic, firm manner.
- + As you conduct the hands-on-examination, ask the patient where it hurt the most. (Can use the 1 to 10 scale)
- + The location of the greatest pain is probably the injury site.
- + If the patient shows no sign of injury, ask the patient to move the limb carefully.

### **Advantages of Splinting**

- ☛ Prevents the movement of broken bone ends, a dislocated joint, or damaged soft tissues.
- ☛ Helps to control bleeding.
- ☛ Decreases the risk of additional damage.
- ☛ Prevents closed fractures from becoming open fractures during movement or transport.
- ☛ Cover all open wounds with a dry, sterile dressing before applying splints.

### **Splinting**

- ✓ Do not move the patient before splinting, unless there is an immediate danger.
- ✓ Immobilize the joint above and below the injury site.
- ✓ Pad all rigid splints.
- ✓ Support the injury site and minimize movement of the limb until splinting is completed.
- ✓ Splint the limb without moving it unnecessarily.
- ✓ When in doubt, splint.

### **Rigid Splints**

- ❖ Made from firm material.

- ❖ Applied to the sides, front or back of an injured extremity.
- ❖ Common types: padded board splints, molded plastic or aluminum splints, padded wire ladder splints, SAM splints, and folded cardboard splints.

### **Soft Splints**

- The most commonly used soft splints are vacuum splints and inflatable, clear plastic air splints.
- Vacuum splints consist of an inner and outer layer of airtight fabric that is shaped to fit around an arm or a leg.
- Air splints are constructed of a clear flexible plastic material.

## **PATIENT HANDLING AND TRANSPORTATION**

In this lesson we will be concentrating on the handling and transportation of a patient to a medical facility. Because it is often impossible for medical help to go the accident scene and treat an injured victim. Also, the site of an accident is seldom an ideal location for providing proper medical care. It may be both hazardous and non-sterile. Therefore, it is not hard to understand why this lesson is so important because of the extreme care that is needed when handling and transporting the patient so as not to cause any further harm to the victim. So, when handling and transporting a patient extreme care should be taken and good teamwork should be utilized to assure no further harm will be caused to the victim. Handling and transporting the victim are often done by the EMT's but, it is still a good idea to have a working knowledge of how it's done so you can assist when you are needed.

Moving a victim is precise work. It calls for close teamwork and care. Even the act of placing the victim on a stretcher demands coordination and practice. The simple movements involved in lifting the stretcher bound victim and walking with him/her call for specific procedures. Let's discuss these procedures.

### **Handling the Patient**

In those instances when we must move a patient from the accident scene to reach the Emergency Medical Services "EMS" personnel we must remember these important aspects of handling a victim prior to placing him/her on a stretcher.

- Scene Safety
- Body Substance Isolation "BSI"

- Quickly assess the victim and treat any life threats.
- Does the victim need to be moved? Only move when necessary!
- Note location of the body prior to movement.
- Move the victim as few times as possible. If possible, wait for more help.
- Move the body as a unit. Using proper lifting techniques and body mechanics.
- One rescuer should give commands and always work in unison as a team.

Patients who have not suffered a trauma injury should be placed in a side lying or recovery position.

- Helps maintain an open airway.
- Allows the drainage of secretions.

### **Emergency Movement of Patients**

Immediately move patients in the following situations:

- Unsafe scene that cannot be made safe.
- Hazardous materials are present
- Danger of fires or explosions exist
- Patient has experienced cardiac arrest
- To gain access to other patients who have life threatening conditions